TOSHIBA

UNINTERRUPTIBLE POWER SYSTEM

THREE-PHASE 80 kVA UPS

4200*FA*

User's Manual

Distributed by
POWERCOM
800-288-9807

Document Number: 56418-004
Date: November 2007

4200*FA*

THREE-PHASE 80 kVA

UNINTERRUPTIBLE POWER SYSTEM

USER'S MANUAL

FOR MODELS

T42F3F800FAXXN
T42F3#800FAXXN
T42#3F800FAXXN

TOSHIBA INTERNATIONAL CORPORATION

INDUSTRIAL DIVISION

13131 West Little York Road
Houston, TX 77041-9990

IMPORTANT NOTICE

The Instructions contained in this manual are not intended to cover all of the details or variations in equipment or to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be required or should particular problems arise which are not covered sufficiently the matter should be referred to the local TOSHIBA sales office.

The contents of this instruction manual shall not become a part of or modify any prior or existing equipment, commitment, or relationship. The sales contract contains the entire obligation of TOSHIBA INTERNATIONAL CORPORATION. The warranty contained in the contract between the parties is the sole warranty of TOSHIBA, and any statements contained herein do not create new warranties or modify the existing warranty.

Any Electrical or mechanical modifications to this equipment without prior written consent of the TOSHIBA will void all warranties and may void UL/CUL listing. Unauthorized modifications may also result in equipment damage, personal injury, or loss of life.

UNINTERRUPTIBLE POWER SYSTEM

If additional information or technical assistance is required call TOSHIBA Customer Support Center toll free at 1- 800-231-1412, or write to: Toshiba International Corporation, 13131 West Little York Road, Houston, TX 77041-9990 Attn: UPS Product Manager.

Please complete the following information for your records. Unless otherwise specified on the warranty card, the warranty period for the UPS or UPS part is 36 months from the shipment date (see bill of lading).

Unless otherwise specified on the warranty card, the warranty period for a UPS battery is 24 months from the shipment date (see bill of lading).

Keep this manual with the UPS equipment.

Job Number:_____

Model Number: _____

Serial Number:_____

Application:_____

Shipping Date:_____

Date of Installation:_____

Inspected By:_____

Purpose and Scope of Manual

This manual provides information on how to safely install, operate, and maintain your TOSHIBA power electronics product. This manual includes a section on General Safety Instructions that describes the warning labels and symbols that are used throughout the manual. Read the manual completely before installing, operating, or performing maintenance on this equipment.

This manual and the accompanying drawings should be considered a permanent part of the equipment and should be readily available for reference and review. Dimensions shown in the manual are in metric and/or the English equivalent.

TOSHIBA reserves the right, without prior notice, to update information, make product changes, or to discontinue any product or service identified in this publication.

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Contacting TOSHIBA Customer Support Center

The TOSHIBA Customer Support Center can be contacted to obtain help in resolving any **Uninterruptible Power System** problem that you may experience or to provide application information.

The center is open from 8 a.m. to 5 p.m. (CST), Monday through Friday. The Support Center's toll free number in USA is (800) 231-1412.

You may contact TOSHIBA by writing to:

TOSHIBA INTERNATIONAL CORPORATION.
INDUSTRIAL DIVISION
13131 West Little York Rd.
Houston, TX 77041-9990
Attn: UPS Product Manager

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GENERAL SAFETY INSTRUCTIONS

DO NOT attempt to install, operate, maintain or dispose of this equipment until you have read and understood all of the product safety information and directions that are contained in this manual.

Safety Alert Symbol

The **Safety Alert Symbol** indicates that a potential personal injury hazard exists. The symbol is comprised of an equilateral triangle enclosing an exclamation mark.

Signal Words

Listed below are the signal words that are used throughout this manual followed by their descriptions and associated symbols. When the words **DANGER**, **WARNING** and **ATTENTION** are used in this manual they will be followed by important safety information that must be carefully adhered to.

Warnings in this manual may appear in any of the following ways:

1) *Danger warning* ─ The danger symbol is an exclamation mark enclosed in a triangle, which precedes the word “DANGER.” The Danger warning symbol is used to indicate situations, locations, and conditions that exist and will cause serious injury or death.

DANGER

2) *Caution warning* ─ The caution symbol is an exclamation mark enclosed in a triangle, which precedes the word “CAUTION.” The Caution warning symbol is used to indicate situations and conditions that can cause operator injury and/or equipment damage.

CAUTION

3) *Attention warning* ─ The attention warning symbol is an exclamation mark enclosed in a triangle which precedes the word “ATTENTION.” The Attention warning symbol is used to indicate situations and conditions that can cause operator injury and/or equipment damage.

ATTENTION

Other warning symbols may appear along with the *Danger* and *Caution* symbol and are used to specify special hazards. These warnings describe particular areas where special care and/or procedures are required in order to prevent serious injury and possible death.

1) *Electrical warning* ─ The electrical warning symbol is a lighting bolt enclosed in a triangle. The Electrical warning symbol is used to indicate high voltage locations and conditions that may cause serious injury or death if the proper precautions are not observed.

2) *Explosion warning* ─ The explosion warning symbol is an explosion image enclosed in a triangle. The Explosion warning symbol is used to indicate locations and conditions where molten exploding parts that may cause serious injury or death if the proper precautions are not observed.

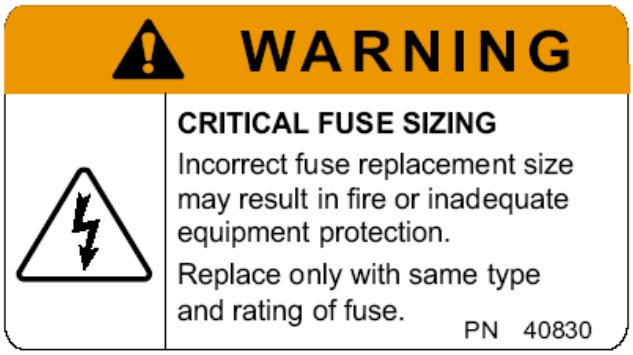
EQUIPMENT WARNING LABELS

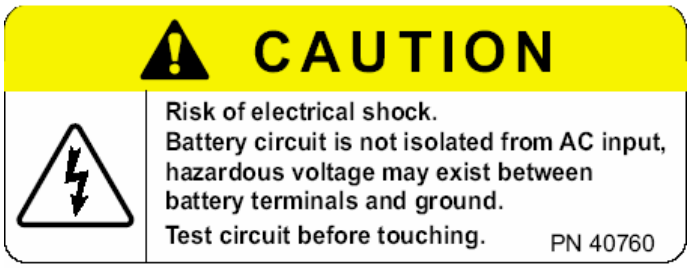
DO NOT attempt to install, operate, maintain or dispose of this equipment until you have read and understood all of the product warnings and user directions that are contained in this instruction manual.

Shown below are examples of warning labels that may be found attached to the equipment. **DO NOT** remove or cover any of the labels. If the labels are damaged or if additional labels are required, contact your TOSHIBA representative for additional labels.

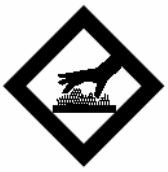
The following are examples of the warning labels that may be found on the equipment. The labels are there to provide useful information or to indicate an imminently hazardous situation that may result in serious injury, severe property and equipment damage, or death if the instructions are not followed.

DANGER
DC VOLTAGE
DC Voltage supplied by batteries is still present after equipment has been turned off and taken off line.
Accidental contact with live parts can cause personal injury and death.
Disconnect all DC Sources before performing any service or testing in this compartment
43784


WARNING
CRITICAL FUSE SIZING
Incorrect fuse replacement size may result in fire or inadequate equipment protection.
Replace only with same type and rating of fuse.
PN 40830


CAUTION
Risk of electrical shock.
Battery circuit is not isolated from AC input, hazardous voltage may exist between battery terminals and ground.
Test circuit before touching.
PN 40760

CAUTION



Hot surface.

Contact may result in burn injury.

Allow equipment to cool before servicing.

PN 40832

CAUTION

Heat sink not grounded.

Risk of electrical shock.

Disconnect UPS and electrically test heat sink before touching.

PN 40831

DANGER

HAZARDOUS VOLTAGES

Hazardous voltages are used in the operation of this equipment and could cause severe personal injury or loss of life.
The following precautions should be observed to reduce the risk of injury or death.

Only qualified technicians familiar with this equipment and the information supplied with it should be permitted to install and operate this equipment.

Installation of electrical equipment must be done in accordance with National Electrical Code and any other state or local codes. Proper grounding and conductor sizing must be installed for safe operation.

During operation, keep all covers in place and cabinet doors shut.

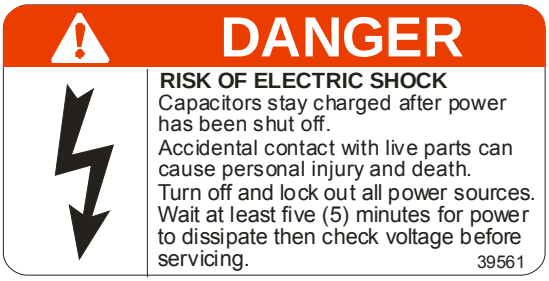
When performing visual inspections and maintenance, if possible, be sure the UPS is turned off and the incoming AC feed is turned off and locked out.
The UPS and Battery Cabinet will have hazardous voltages present even after the AC feed is turned off.

If it is necessary to make measurements with the power on, do not touch any electrical connection points. Remove all jewelry from wrists and fingers. Make sure test equipment is in good, safe operating condition.

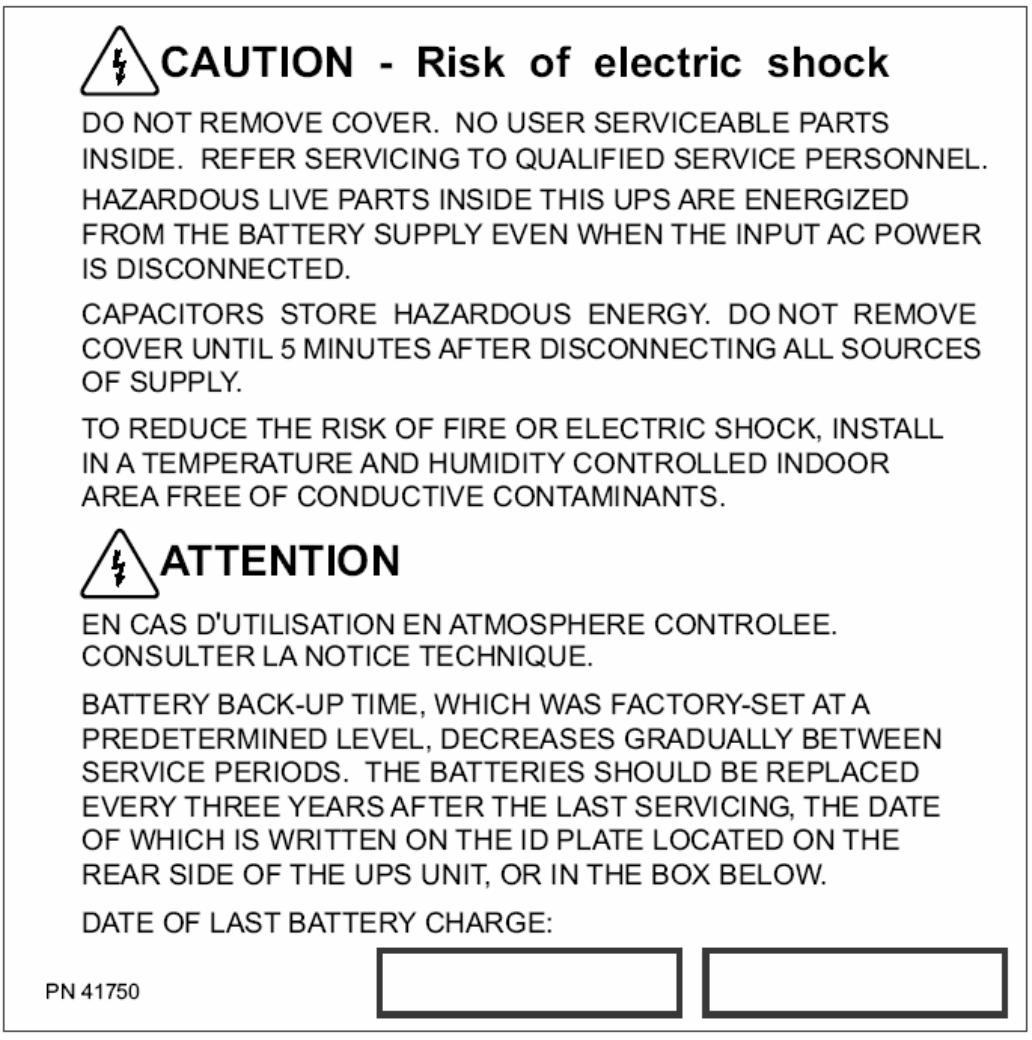
While servicing, stand on some type of insulation, and be sure not to be grounded.

Follow the safety instructions given in the equipment manual carefully and observe all danger, warning and caution notices.

40308


DANGER
RISK OF ELECTRIC SHOCK
Capacitors stay charged after power has been shut off.
Accidental contact with live parts can cause personal injury and death.
Turn off and lock out all power sources. Wait at least five (5) minutes for power to dissipate then check voltage before servicing.
39561

(For Battery Units Only)


CAUTION - Risk of electric shock
DO NOT REMOVE COVER. NO USER SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.
HAZARDOUS LIVE PARTS INSIDE THIS UPS ARE ENERGIZED FROM THE BATTERY SUPPLY EVEN WHEN THE INPUT AC POWER IS DISCONNECTED.
CAPACITORS STORE HAZARDOUS ENERGY. DO NOT REMOVE COVER UNTIL 5 MINUTES AFTER DISCONNECTING ALL SOURCES OF SUPPLY.
TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, INSTALL IN A TEMPERATURE AND HUMIDITY CONTROLLED INDOOR AREA FREE OF CONDUCTIVE CONTAMINANTS.
ATTENTION
EN CAS D'UTILISATION EN ATMOSPHERE CONTROLEE. CONSULTER LA NOTICE TECHNIQUE.
BATTERY BACK-UP TIME, WHICH WAS FACTORY-SET AT A PREDETERMINED LEVEL, DECREASES GRADUALLY BETWEEN SERVICE PERIODS. THE BATTERIES SHOULD BE REPLACED EVERY THREE YEARS AFTER THE LAST SERVICING, THE DATE OF WHICH IS WRITTEN ON THE ID PLATE LOCATED ON THE REAR SIDE OF THE UPS UNIT, OR IN THE BOX BELOW.
DATE OF LAST BATTERY CHARGE:
PN 41750

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

This manual contains important instructions that should be followed during the installation, operation, and maintenance of the UPS and its batteries. Turn off, lockout, and tagout all power sources before proceeding to connect the power wiring to the equipment or when performing maintenance. Hardwire type UPS units are not equipped with an over-current protection device nor an output disconnect for the AC output. Therefore, a circuit breaker should be provided by the user between the UPS output and the load input. This device should be rated as follows:

Device Type	80 kVA
Rated Output	208/120 VAC
Device Rating	240 V, 300 A

The maximum ambient temperature in which the UPS unit should be operated is **40°C (104°F)**.

The nominal battery voltage is 288VDC.

Only a qualified TOSHIBA Representative who is knowledgeable in batteries and the required precautions should only perform battery servicing. Keep unauthorized personnel away from batteries. To arrange for battery replacement, contact TOSHIBA for service.

Qualified Personnel ONLY

A Qualified Person is one that has the skills and knowledge relating to the construction, installation, operation, and maintenance of this electrical equipment and has received safety training on the hazards involved (Refer to the latest edition of NFPA 70E for additional safety requirements).

Qualified Personnel Shall:

1) Have carefully read the entire operation manual.
2) Be trained and authorized to safely energize, de-energize, ground, lockout/tagout circuits and equipment, and clear faults in accordance with established safety practices.
3) Be trained in the proper care and use of protective equipment such as safety shoes, rubber gloves, hard hats, safety glasses, face shields, flash clothing, etc., in accordance with established safety practices.
4) Be trained in rendering first aid.
5) Be knowledgeable of batteries and the required precautions.

For further information of workplace safety visit www.osha.gov.

Refer to the Battery System Manual when scheduling battery maintenance or battery replacement.

DANGER Misuse of this equipment could result in injury and equipment damage. In no event will TOSHIBA Corporation be responsible or liable for indirect, or consequential damage or injury that may result from the use of this equipment.

CAUTION

Do not dispose of the batteries in a fire. The batteries may explode.

CAUTION Do not open or mutilate the batteries. Released electrolyte is toxic and harmful to the eyes and skin.

CAUTION This unit contains sealed lead acid batteries. Lack of preventative maintenance could result in batteries exploding and emitting gasses and/or flame. An authorized technician must perform annual preventative maintenance.

CAUTION Failure to replace a battery before it becomes exhausted may cause the case to crack; possibly releasing electrolyte from the battery resulting in secondary faults such as odor, smoke, and fire.

CAUTION Only personnel knowledgeable of batteries and the required precautions should perform installation and servicing of batteries. Keep unauthorized personnel away from the batteries.

CAUTION Proper maintenance to the battery system of this unit must be done by a qualified service technician. This is essential to the safety and reliability of your UPS system. Refer to service manual.

DANGER ***A battery can present a risk of electrical shock and high short circuit current.*** The following precautions should be observed when working with batteries:

TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY!

1) Verify that the UPS is off and is disconnected from the power source.
2) Remove watches, rings, jewelry, or other metal objects.
3) Use tools with insulated handles to prevent inadvertent shorts.
4) Wear rubber gloves and boots.
5) Do not place tools or metal parts on top of the batteries.
6) Determine if the battery is inadvertently grounded. If inadvertently grounded, remove source of ground. ***Contact with any part of a grounded battery can result in electrical shock.*** The likelihood of such shock will be reduced if such grounds are removed during installation and maintenance.
7) Verify circuit polarities prior to making connections.
8) Disconnect charging source and load prior to connecting or disconnecting terminals.
9) VRLA batteries contain an explosive mixture of hydrogen gas. Do not smoke, or create a flame or spark in the immediate area of the batteries. This includes static electricity from the body.
10) Do not attempt to open the batteries in order to add water or sample the specific gravity of the electrolyte. The batteries are valve-regulated lead acid type and such servicing is not possible without damaging the battery.
11) Use proper lifting means when moving batteries and wear all appropriate safety clothing and equipment.
12) Do not dispose of lead acid batteries except through channels in accordance with local, state and federal regulations.

INSTRUCTIONS IMPORTANTES CONCERNANT LA SÉCURITÉ

CONSERVER CES INSTRUCTIONS

Cette notice contient des instructions importantes concernant la sécurté

ATTENTION Un batterie puet présenter un risque de choc électrique, de brûlure par transfert d' énergie.

ATTENTION L'élimination des batteries est règlementèe. Consultar les codes locaux à cet effet

1.0 Product Description

1.1 Theory of Operation

An Uninterruptible Power System (UPS) is a system that is installed between the commercial power and the load equipment. The UPS provides steady AC output power during commercial power fluctuations and interruptions.

During normal operation the UPS receives commercial AC power and removes any high voltage spikes and transients caused by switching or faults on the main utility. The result of this process is maximum power conditioning and regulation of the power applied to the load.

If the AC power supplied to the UPS drops below a specified voltage level, the batteries of the UPS are automatically switched on and will supply power to the load. This insures that the loads connected to the UPS continue to receive power with no interruption. This power is provided for a period long enough to ensure that the load can be shut down in an orderly fashion. This prevents loss of data and possible damage to the hardware or software.

When AC input power becomes available again, normal system operation resumes and the UPS battery-charge cycle resumes.

1.2 Application and use

The TOSHIBA 4200FA Uninterruptible Power Systems (UPS) provide continuous computer grade AC power in a compact and efficient high-performance unit. The UPS assures safe, reliable operation of critical office equipment, ranging from personal computers to mini-computers to local area networks (LAN). All units feature an audible alarm that sounds if the battery voltage drops below standard during use. This is an additional aid to help in retaining the valuable office data banks, and all units allow for computer interfacing.

1.3 Power Backup

During an electrical power failure the batteries of the UPS unit supply DC power to the inverter that supports the load equipment automatically, without interruption. For example, when used to support a computer, a UPS backup assures additional time to complete your activity and store data after a power failure occurs.

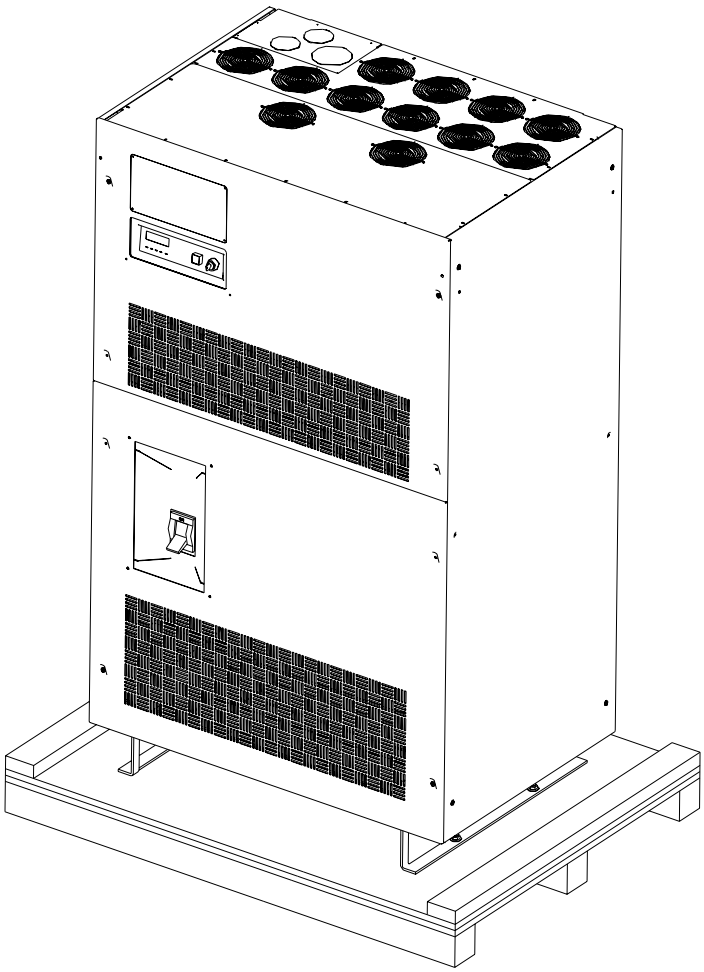
1.4 Power Conditioning

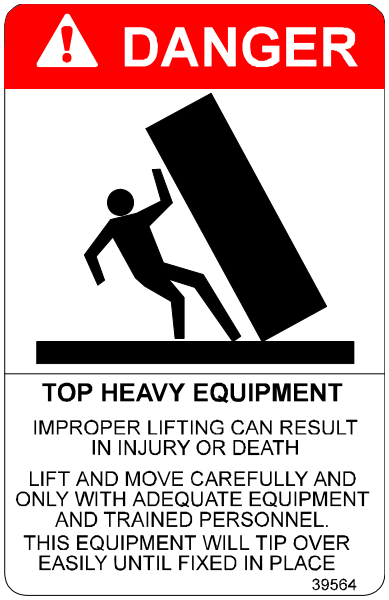
While commercial power is present, the UPS supplies conditioned power to the load while maintaining the batteries in a charged condition. The UPS protects the connected load against the normal everyday problems associated with heavy use of raw commercial power, including power sags, surges, signal interference, and spikes. This protection keeps power-line problems from reaching your load where it can cause equipment to operate erratically, or damage software or hardware.

2.0 Unpacking/Inspection/Storage/Disposal

2.1 Unpacking the UPS Equipment

1) Upon receipt of the UPS, a careful inspection for shipping damage should be made.
2) For international units, remove the screws that attach the shipping crate panels to each other and to the pallet. Remove the crate and foam packing material.
3) Unbolt the unit from the shipping pallet.
4) Lift the UPS from the pallet using a forklift that has sufficient capacity. Approach the UPS only from the front or rear.




DANGER
TOP HEAVY EQUIPMENT
IMPROPER LIFTING CAN RESULT IN INJURY OR DEATH
LIFT AND MOVE CAREFULLY AND ONLY WITH ADEQUATE EQUIPMENT AND TRAINED PERSONNEL.
THIS EQUIPMENT WILL TIP OVER EASILY UNTIL FIXED IN PLACE
39564

CAUTION ***Do not attempt to move the unit by the sides. Only move the unit with a forklift or pallet jack.*** Moving the unit by pushing on the sides may result in damage to the unit or injury to personnel.

2.2 UPS Equipment Inspection

UPS Equipment Inspection

Upon receipt of the UPS, a careful inspection for shipping damage should be made. Use caution when removing unit from pallet. Refer to labels or documentation attached to packing material.

After Unpacking

1) Check the unit for loose, broken, bent or other damaged parts. If damage has occurred during shipment, keep all packing materials for return to the shipping agent. The equipment warranty will not apply to units that are damaged during shipment.
2) Check to see that the rated capacity and the model number specified on the nameplate conform to the order specifications.

2.3 Storage of the UPS Equipment

If the UPS equipment is to be subject to long or short-term storage, the following guidelines should be used.

Avoid:

1) Storage in sites subject to extreme changes in temperature or high humidity.
2) Storage in sites subject to exposure of high levels of dust or metal particles.
3) Storage on inclined floor surfaces or in sites subject to excessive vibration.

Before Storing:

1) Allow the UPS to be operated for 24 hours to ensure that the batteries are fully charged.
2) Stop the unit (see Shutdown Procedure in section 6.12).
3) Place the MCCB switch of the UPS in the OFF position (see section 4.1 for location).

Storing:

1) Store within the temperature range of -4 – 104 °F (-20 – 40 °C).
2) For best results, store the UPS in the original shipping container and place on a wood or metal pallet.
3) The optimum storage temperature is 70 °F (21 °C). Higher ambient temperatures cause UPS batteries to require recharging more frequently.

After Storing:

1) If stored in an ambient temperature less than 68 °F (20 °C); recharge the batteries every 9 months.
2) If stored in an ambient temperature of 68 – 86 °F (20 – 30 °C); recharge the batteries every 6 months.
3) If stored in an ambient temperature of 86 – 104 °F (30 – 40 °C); recharge the batteries every 3 months.

2.4 Disposal

Please contact your state environmental agency for details on proper disposal of electrical components and packaging in your particular area.

ATTENTION

It is illegal to dump lead-acid batteries in landfills or dispose of improperly. Please help our Earth by contacting the environmental protection agencies in your area, the battery manufacturer, or call TOSHIBA toll-free at (800) 231-1412 for more information about recycling batteries.

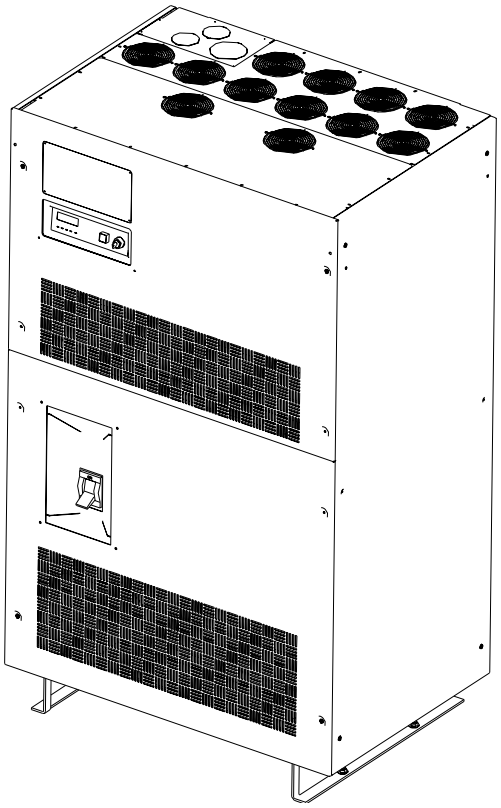
3.0 Precautions

Because of the external dimensions of the 4200FA UPS and the way the outer panels are to be removed; only a minimum amount of space around the unit is required for ventilation and maintenance access. Figure 3.1 shows the minimum clearances required for proper UPS installation.

3.1 Installation Precautions

1) Install the UPS in a stable, level, and upright position that is free of vibration.
2) Install the UPS in a well ventilated location with the required allowances for ventilation and servicing as shown in figure 3.1.
3) Install the UPS where the ambient temperature is within the correct operating range (see the UPS Specifications in section 5). Verify that the ventilation and air conditioning system at the site is capable of removing the heat generated by the UPS unit (see Section, 5 Specifications, "Environment"). Ambient temperature range for operating the UPS is 32 – 104 °F (0 – 40 °C); **77 °F (25 °C) is the recommended operating temperature for maximum battery life.**
4) Do not install the UPS in a location that is subject to high humidity.
5) Do not allow the UPS to be exposed to direct sunlight.
6) Do not install the UPS in areas that are subject to contamination such as high levels of airborne dust, metal particles, or flammable gasses.

7) Avoid installation near sources of electrical noise and always ensure that the earth ground is intact to prevent **electrical shock** and help prevent electrical noise.
8) Do not install the UPS in an area that may expose the UPS to water or that may allow any foreign matter to get inside.
9) This UPS generates and radiates radio-frequency energy during operation. There is no guarantee that the UPS will not influence some sensitive devices that are operating close by. If such interference is experienced, the UPS should be installed farther away from the affected equipment and/or powered from a different source than the affected equipment.
10) The user should provide output over current protection for hardwired UPS versions. See Safety Instructions on page 9 for the correct device rating.



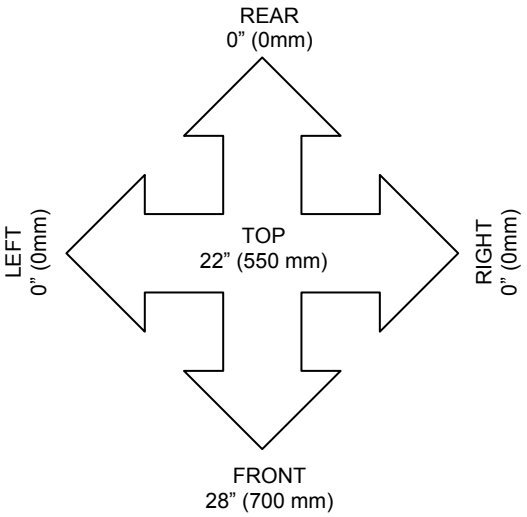


Figure 3.1

11) After ensuring that all power sources are turned off and isolated in accordance with established lockout/tagout procedures, connect power source wiring of the correct voltage to the input terminals of the UPS. Connect the output terminals of the UPS to an applicable load type application (refer to NEC Article 300 – Wiring Methods and Article 310 – Conductors For General Wiring). Size the branch circuit conductors in accordance with NEC table 310.16.

NOTE: Ensure that the input phasing is connected n clockwise rotation (CW). UPS internal circuitry is designed to disable further UPS operation of the input phasing is installed in counter-clockwise rotation (CCW).

3.2 Pre-start Precautions

Before connecting the UPS to a power source; move the MCCB switch to the OFF position and move the operation RUN/STOP key switch, on the front panel (See Section 6.5 for location), to the STOP position.

3.3 Operating Precautions

1) The UPS should not be powered up until the entire User's Manual has been read.
2) The input power source voltage must be within +10% to -15% of the rated input voltage to initially start the UPS. The input frequency must be within the rated input frequency range. Voltages and frequencies outside of the permissible range may activate the internal protection device.
3) The UPS should not be used with a load that has a rated input greater than the rated UPS output.
4) Do not use the UPS to provide power to motors that require high starting current or a long starting time such as vacuum cleaners or machine tools (over sizing for locked rotor current required).
5) Do not insert metal objects or combustible materials in the ventilation slots of the UPS.
6) Do not place, hang, or paste any objects on the top or on the exterior surfaces of the UPS.
7) The capacitors of the UPS maintain a residual charge for a while after turning off the UPS. The required discharge time for each UPS is provided via a cabinet label. Wait for at least the minimum time indicated on the label and ensure that the front panel LED's have gone out before removing the front panel of the UPS once the UPS power has been turned off
8) Do not attempt to disassemble, modify, or repair the UPS. Call TOSHIBA Service for repair information.
9) Turn the power on only after attaching **ALL** the covers and **DO NOT** remove any covers of the UPS when the power is on.
10) If the UPS should emit smoke or an unusual odor or sound, turn the power off immediately.
11) The heat sink and other components may become extremely hot to the touch. Allow the unit to cool before coming into contact with these items.
12) Warning signs should be placed on or near the load to let people know that the load is being powered by the UPS.
13) Additional warnings and notifications shall be posted at the equipment installation location as deemed required by **Qualified Personnel**.

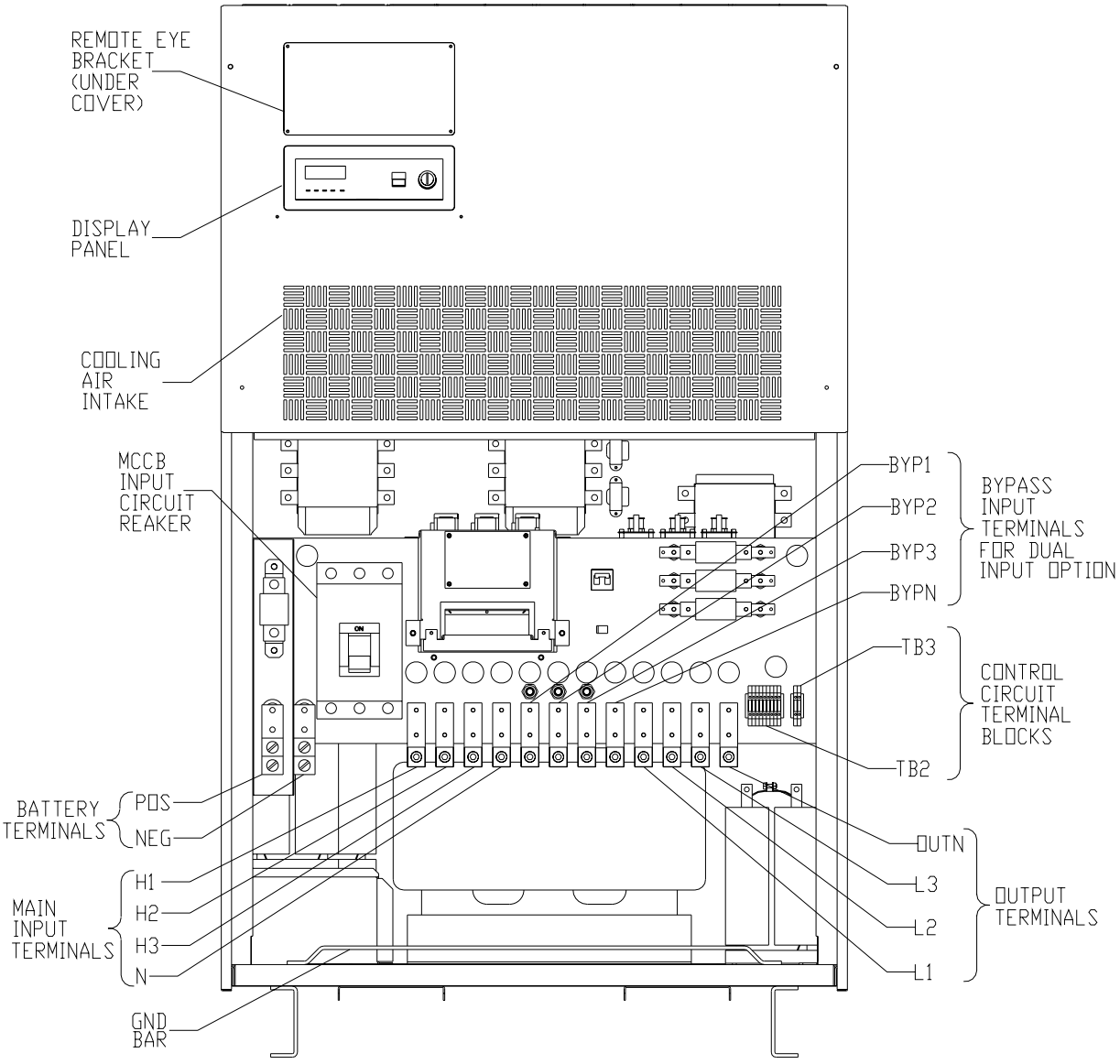
CAUTION When the UPS is in the Inverter mode, turning the breaker to the OFF position will cause the unit to go into the battery backup mode. The UPS will continue to provide power to the load. The unit must be in Bypass mode and then the breaker turned to the OFF position for the UPS to shut down power to the load.

CAUTION Do not EPO (Emergency Power OFF) the UPS and then reset the breaker until the UPS has been fully discharged. The UPS could be damaged if the unit is not fully powered down before the breaker is reset.

4.0 UPS Connections

4.1 UPS Power and Control Connections

The following illustration shows the wiring connections to the input and output termination points and the Control Circuit Terminal Blocks for the 4200***FA*** 80 kVA UPS.



4.1.1 Recommended Wire Size and Tightening Torque for UPS Input/Output Terminals

Minimum/Maximum Wire Size and Tightening Torque of UPS Input and Output Terminals			
Main Input & Bypass Input	**AWG (H1 – H3, BYP1, BYP2, BYP3)**	**AWG (N, BYPN)**	**Tightening Torque (in-lbs.)**
208 VAC	300 MCM to 500 MCM	400 MCM to 500 MCM	375
380, 400, 415 VAC	2/0 AWG to 500 MCM	400 MCM to 500 MCM	375
480 VAC	1/0 AWG to 500 MCM	400 MCM to 500 MCM	375
600 VAC	1/0 AWG to 500 MCM	400 MCM to 500 MCM	375

Output	**AWG (L1, L2, L3)**	**AWG (OUTN)**	**Tightening Torque (in-lbs.)**
208 V/120 VAC	300 MCM to 500 MCM	400 MCM to 500 MCM	375

Battery Circuit	**AWG (POS, NEG)**	**Tightening Torque (in-lbs.)**
288 VDC Nominal	400 MCM to 600 MCM	500

Input/Output Ground	**AWG (GND)**	**Tightening Torque (in-lbs.)**
	2 AWG minimum (see note 1)	(see note 2)

All wire sizes are per NEC

Use copper wiring with at least 90°C rated insulation

Neutral Conductors are rated @ 1.73 or 200% of phase conductors, per NEC

Note 1: Use a UL listed lug suitable for the wire size used.

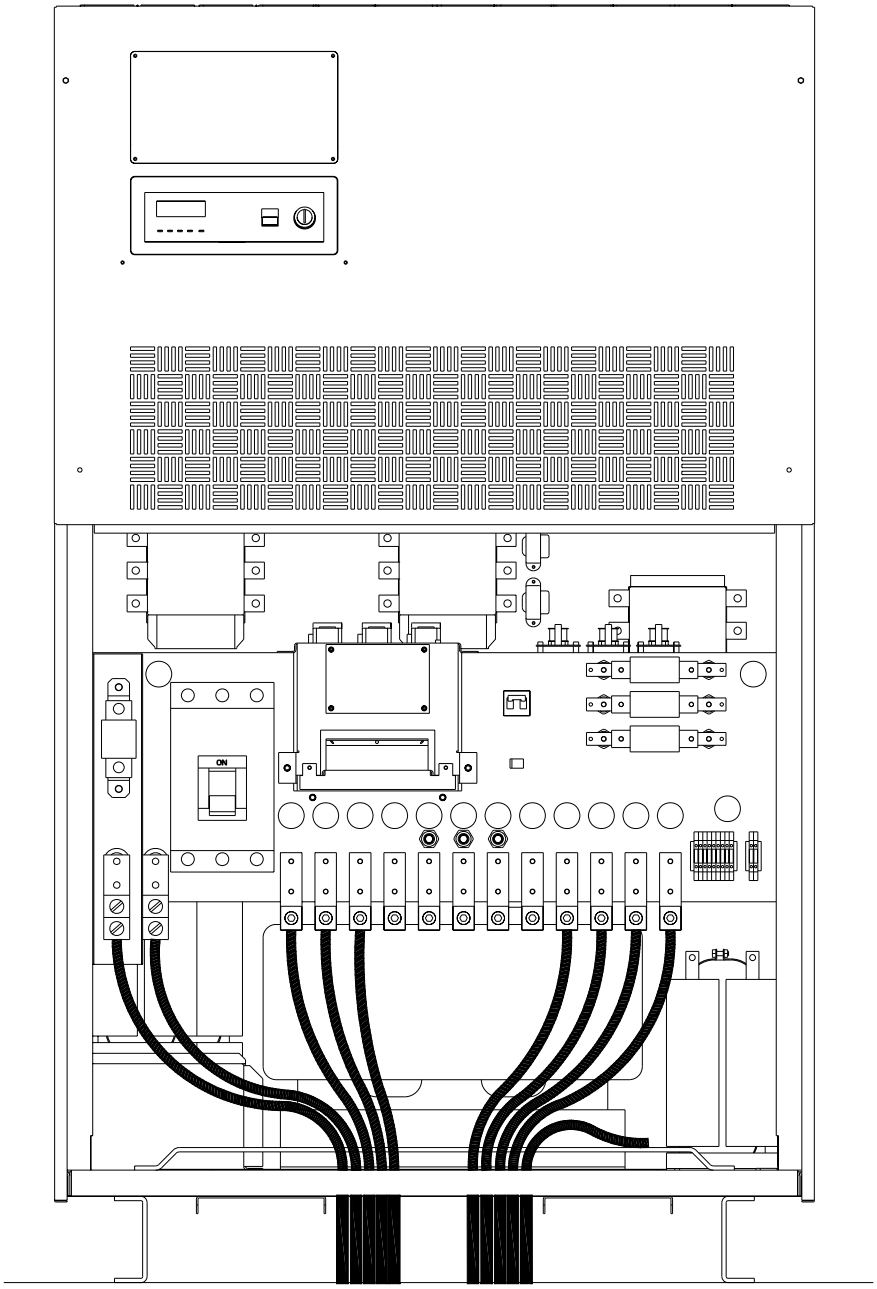
Note 2: Use tightening torque recommended by manufacturer of lug used.

4.1.2 Power Connection Cable Routing

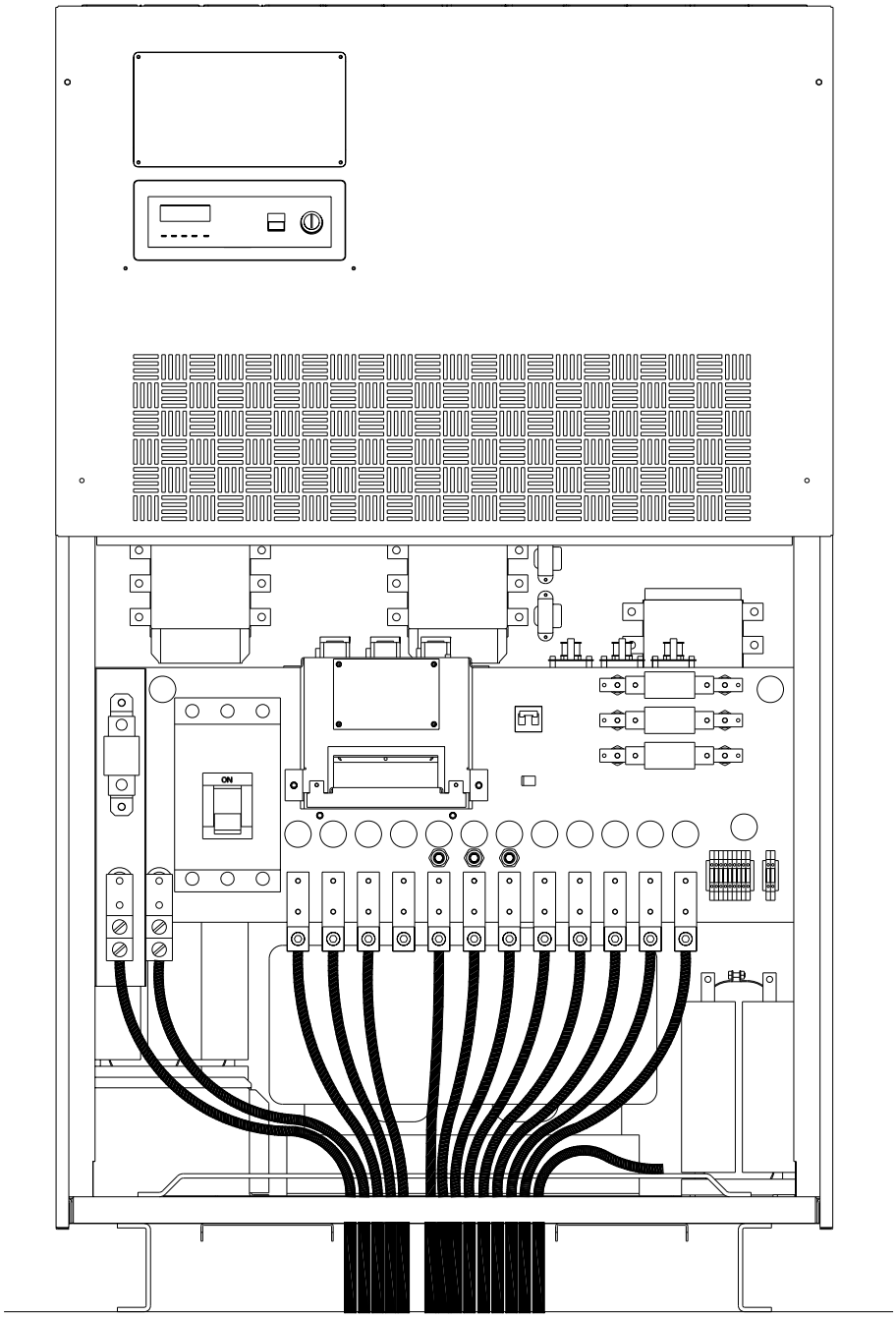
1) Use separate metal conduits for routing the input power, output power, battery, and control circuits.
2) A separate ground cable should be run inside of the conduit with the input power, output power, and control circuits.
3) Always ground the unit to prevent electrical shock and to help reduce electrical noise.
4) Follow wire size and tightening torque recommendations provided in this manual.

CAUTION **THE METAL OF A CONDUIT IS NOT AN ACCEPTABLE GROUND**

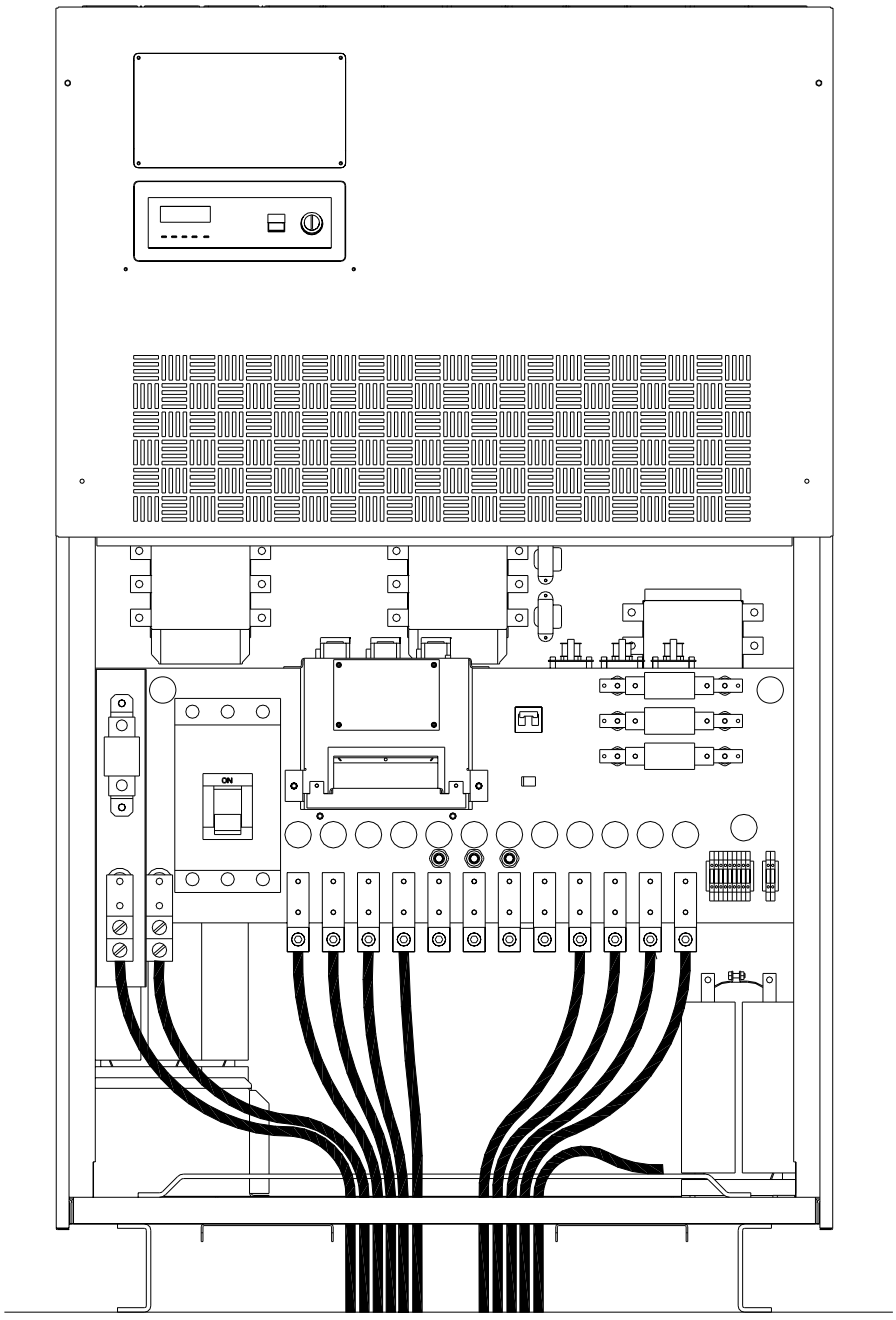
Single Input UPS with input transformer. Shown with bottom cable entry configuration.



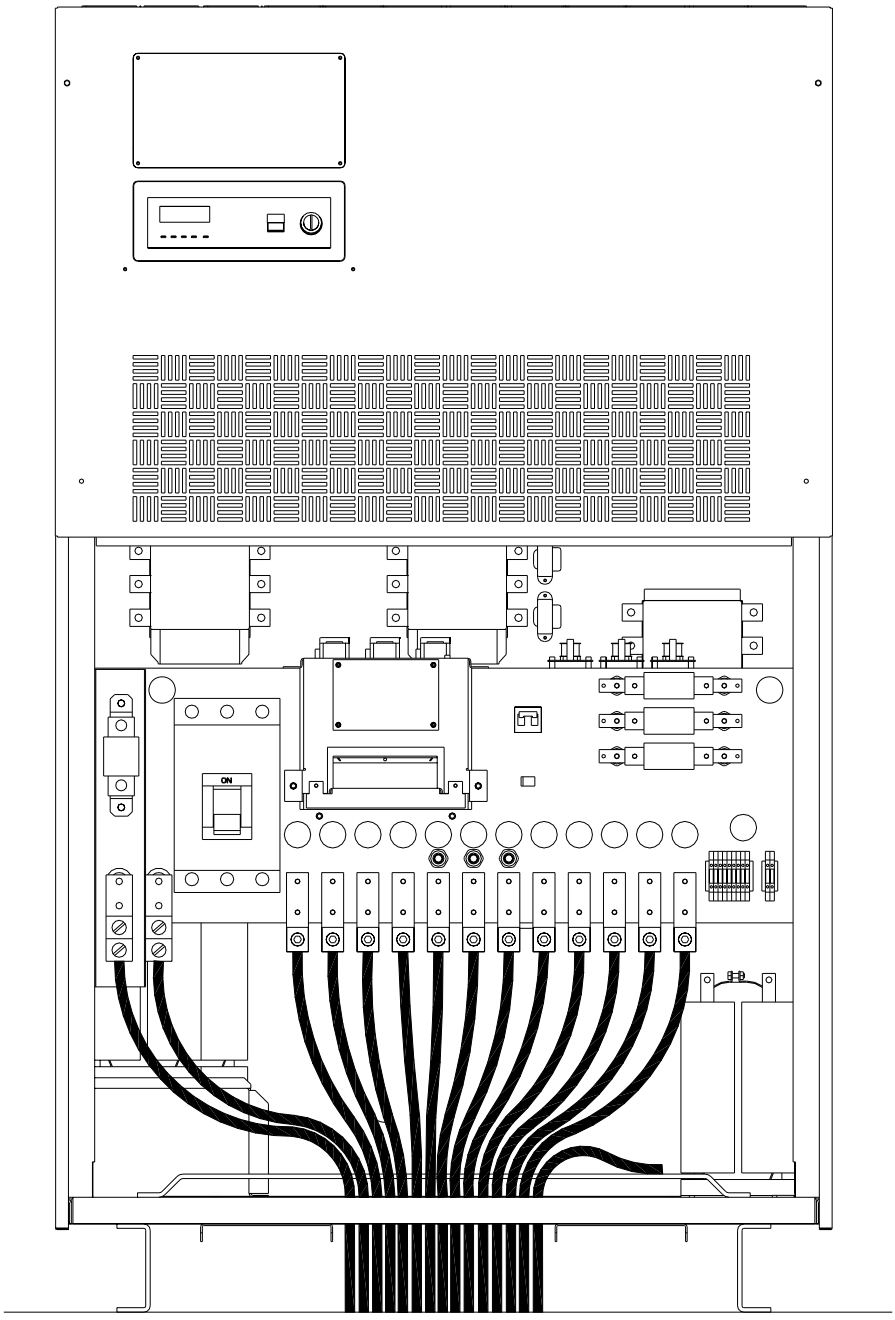
Dual Input UPS with input transformer. Shown with bottom cable entry configuration.



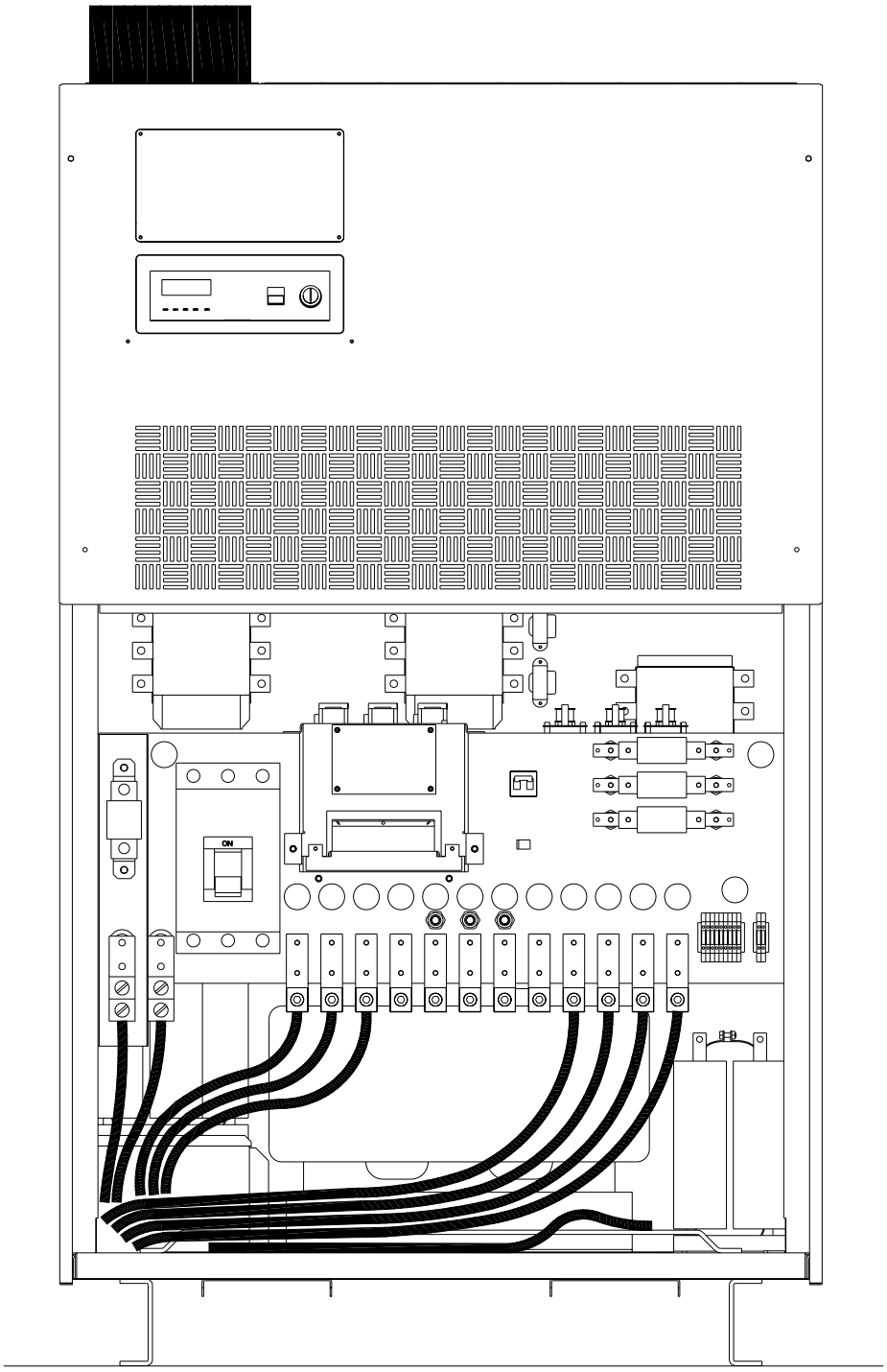
Single Input UPS with no transformers. Shown with bottom cable entry configuration.



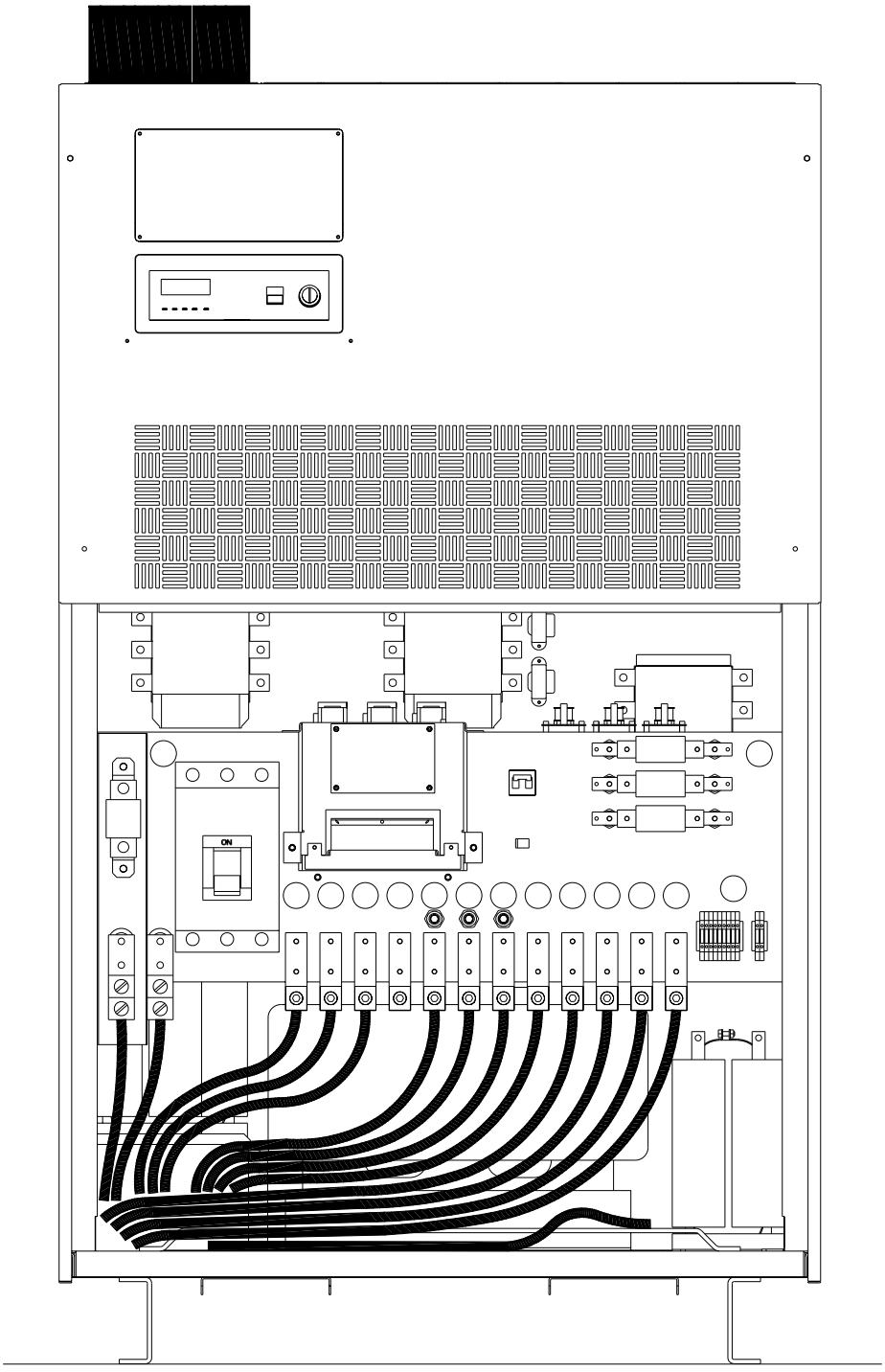
Dual Input UPS with no transformers. Shown with bottom cable entry configuration.



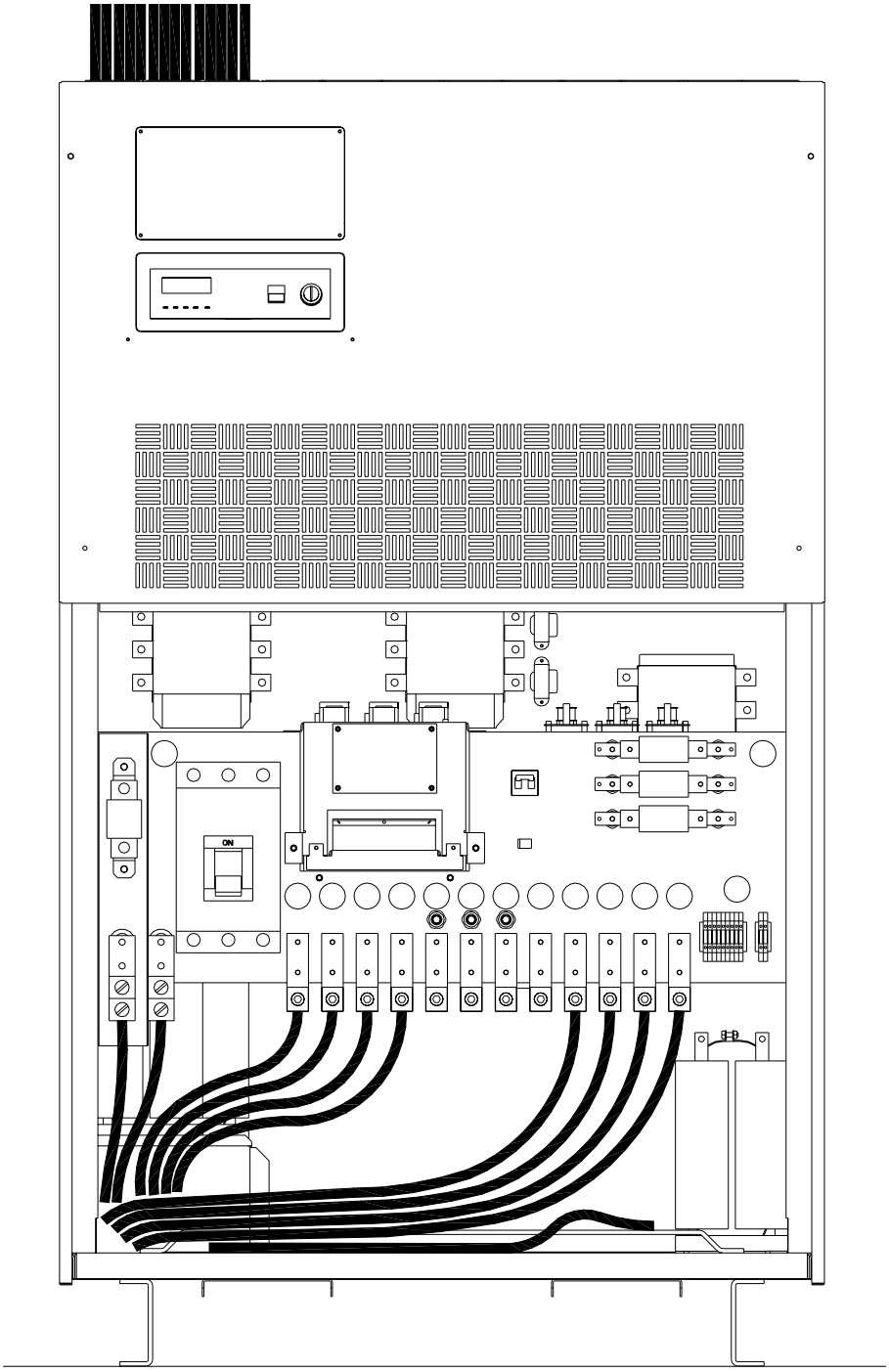
Single Input UPS with input transformer. Shown with top cable entry configuration.



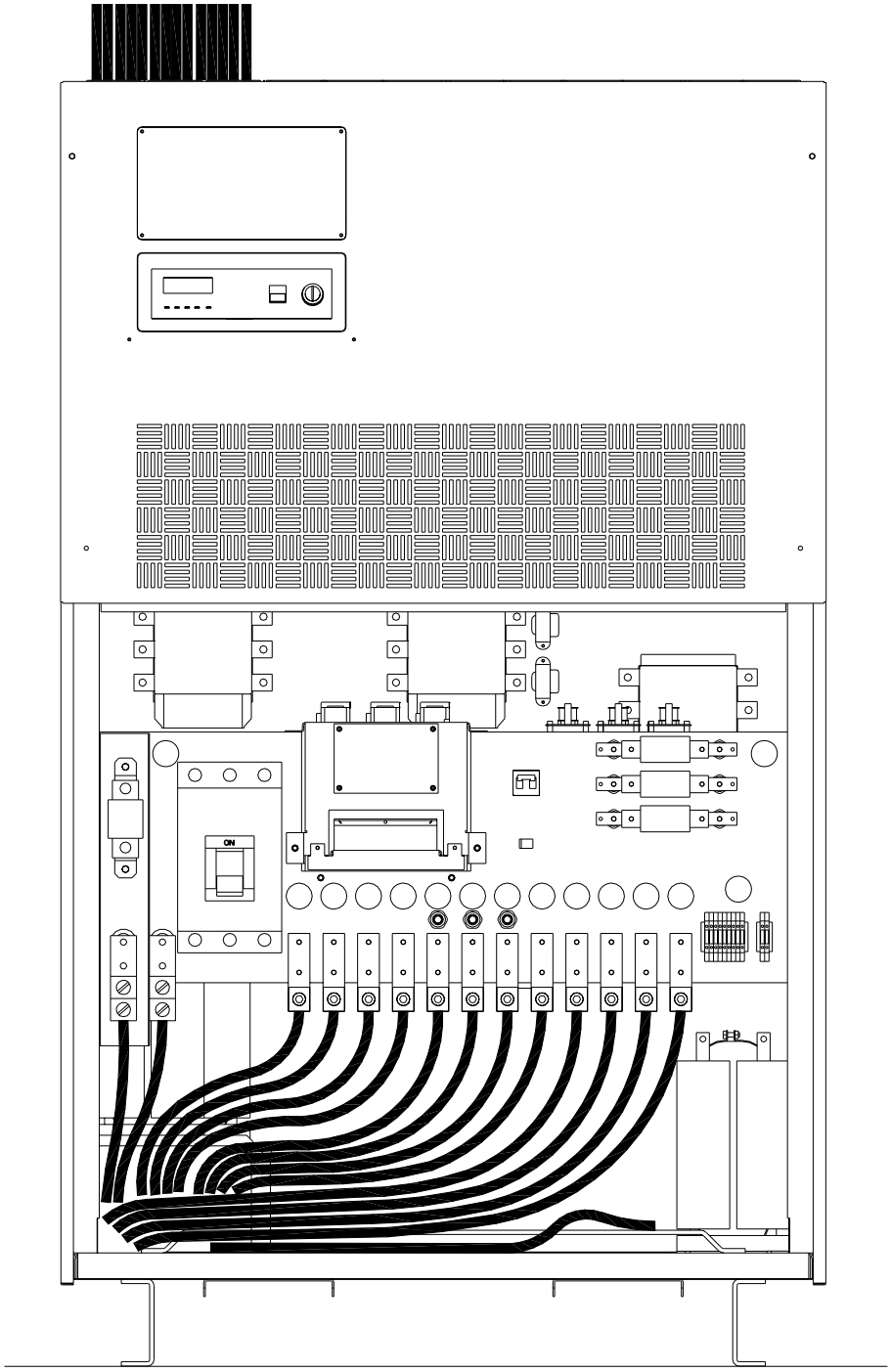
Dual Input UPS with input transformer. Shown with top cable entry configuration.



Single Input UPS with no transformers. Shown with top cable entry configuration.

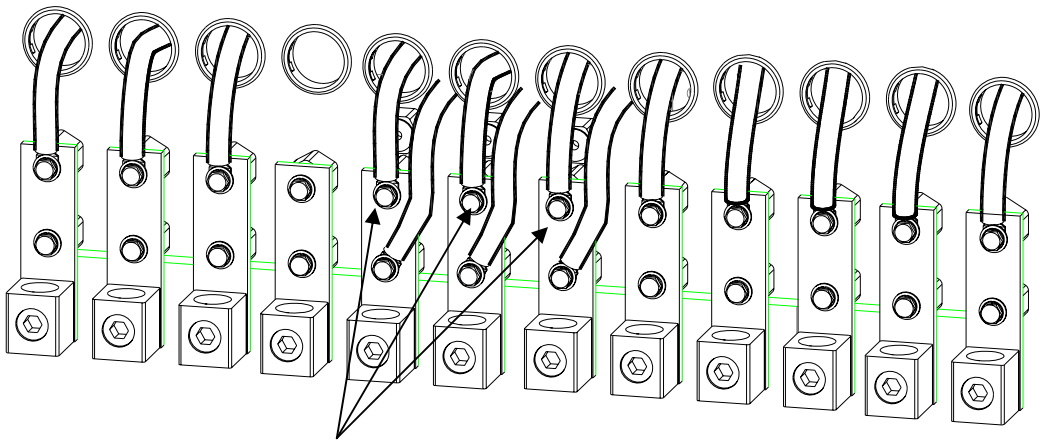


Dual Input UPS with no transformers. Shown with top cable entry configuration.



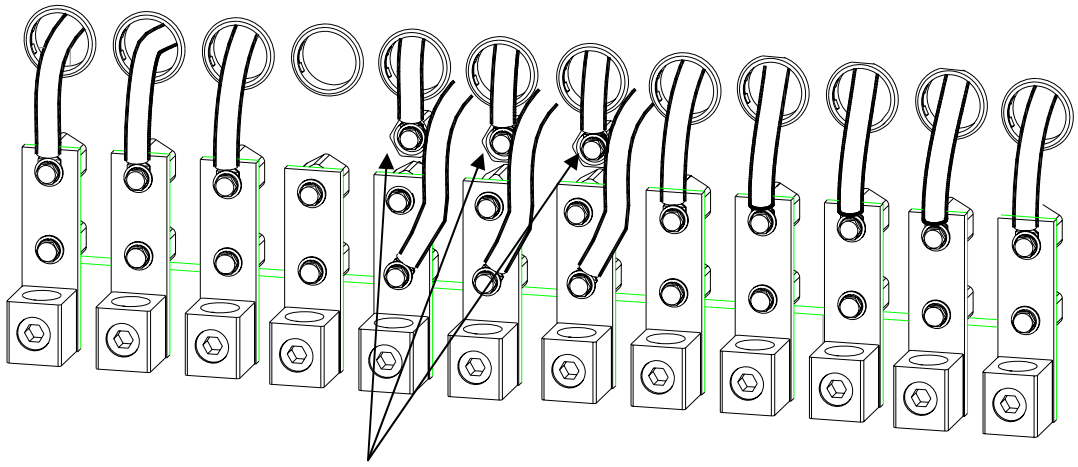
4.1.3 Dual Input Configuration

Units are shipped from the factory wired for single input configuration. For those requiring a dual input configuration see below. This change should only be performed by factory trained service personnel and not by the end user.



Bypass jumpers are factory installed on bypass bus bars.

Single Input Configuration

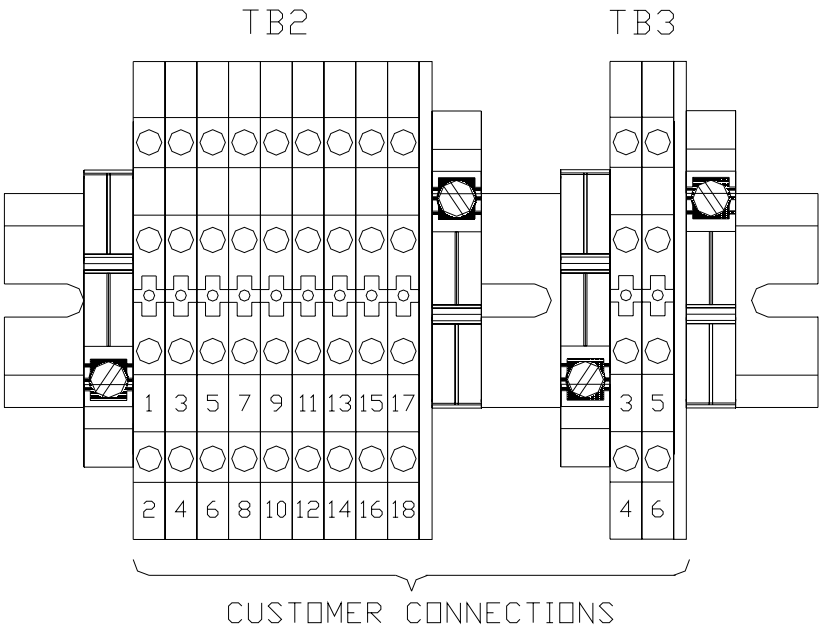


Move wires from bypass bus bars to stand offs to configure for dual input.

Dual Input Configuration

4.2 Control Circuit and External Battery Interface Connections

The following illustrates the wiring connections of the Control Circuits and Battery Interface Circuits.



TB2 CONNECTIONS	
1 - LOW BATTERY	2 - BATTERY DISCHARGE
3 - FAULT	4 - not used
5 - INVERTER SUPPLY	6 - INVERTER SUPPLY
7 - REMOTE RUN (P24A3)	8 - REMOTE RUN
9 - REMOTE STOP (P24A3)	10 - REMOTE STOP
11 - BYPASS	12 - COMMON
13 - EPO	14 - EPO

TB3 CONNECTIONS	
3 - BATT. SHUNT TRIP OUT	4 - BATT. SHUNT TRIP OUT
5 - BATT. AUX. IN	6 - BATT. AUX. IN

4.1.4 Recommended Wire Size and Tightening Torque UPS Control and Battery Interface

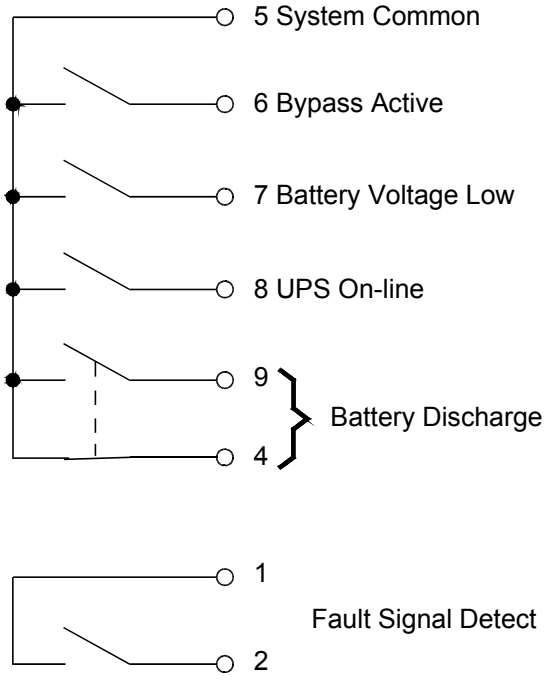
Minimum Wire Size and Tightening Torque for UPS Control and Battery Interface Circuits **USE MINIMUM 75° C COPPER WIRING**		
TERMINAL (TERMINAL #)	**AWG**	**TIGHTENING TORQUE**
*UPS CONTROL CIRCUITS (1-18)	14-16	8 in-lbs.
*BATTERY CONTROL CIRCUITS (3-6)	14-16	8 in-lbs.

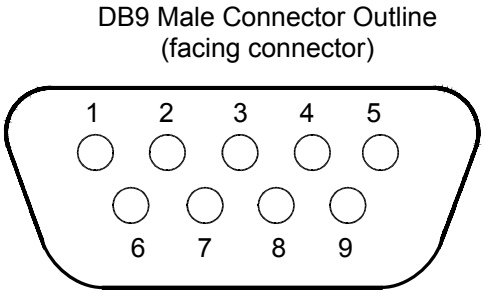
***Indicates Class 1 wiring method is to be used.**

4.2 Communication Interface

4.2.1 Remote Contact

The remote contact interface is a standard feature and is available as dry switch contacts through a DB9 male connector located under the Remote Eye Cover on the front of the UPS (see Section 4 for location). The following schematic shows the contact state and pin assignment for each signal and the associated DB9 connector pin-out.





Notes:

1) Switches are shown in their ***inactive states*** (if battery voltage is low pin 7 will be connected to System Common).

2) Contacts are resistive loads rated at 30 VDC, 0.1 A (125 VAC, 3 A).

3) Pin 3 is not used.

4.2.2 RS-232C

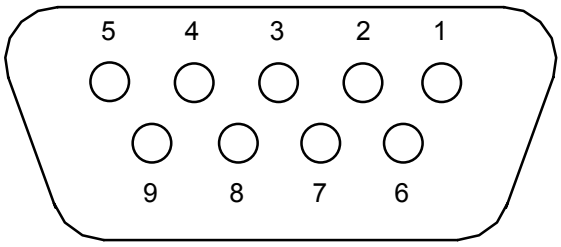
The RS-232C serial communication interface is available via a DB9 female connector located under the Remote Eye Cover on the front of the UPS (see Section 4 for location). This interface allows control of the UPS from a personal computer running special TOSHIBA software. The computer and the UPS are connected through a serial RS-232C communication port. The available data from the UPS, via the RS-232C communication link is shown below.

Operating Conditions	Input Voltage Output Voltage Output Current Battery Voltage Input Frequency Output Frequency
UPS Operating Status (Described as Yes or No)	Utility Power OK Low Battery Voltage Detected UPS in BYPASS Mode UPS in NORMAL Mode Input and Output Frequency Synchronized UPD FAULT Occurred
Fault Details (Described as Occurred or Not Occurred)	DC Bus Over-Current DC Bus Over-Voltage DC Bus Under-Voltage Input Over-Current Overheat Overload Being Timed Overload (allowable time exceeded) Output Over-Voltage (during Normal Mode) Output Under-Voltage (during Normal Mode)

The connector pin assignment and female connector outline are illustrated below.

Pin	I/O	Symbol	Description
1	This pin is not used		
2	Input	RXD	Receive Data
3	Output	TXD	Transmit Data
4	Output	DTR	Data Terminal Ready
5	-	SG	Signal Ground
6	Input	DSR	Data Set Ready
7	Output	RTS	Request To Send
8	Input	CTS	Clear To Send
9	This pin is not used		

DB9 Female connector outline
(facing connector)



4.2.3 UPS Shutdown (via RS-232C)

When the UPS is operating from its internal batteries, a Shutdown order can be sent to the UPS telling it to turn OFF after a user-specified amount of time. This function can allow you to stop discharging the UPS batteries after an orderly system shutdown has been completed. The UPS can be programmed to turn OFF up to 8 minutes after the Shutdown command is given. This command can be cancelled before the specified time has elapsed by following the directions listed on the RS232 screen.

5.0 Specifications

5.1 Specifications – 4200FA 80kVA without Internal Transformer

	Model Number	T42F3F800FAXXN
	Rated Output Capacity	80 kVA
	External Dimen. (WxDxH)	41 in. x 31 in. x 74 in. (1041 mm x 787 mm x 1880 mm)
	Weight	2000 lbs (907 kg)
Main Input	Rated Voltage	208 Vac
	Voltage Variation	+10% to –15% ; (-15% to -30%) ****
	Rated Frequency	50/60 Hz
	Number Phases / Wires	3 Phase / 4 Wire
	* Power Factor	Greater than 0.99 when in inverter mode
	Required Input Power	67 kW when in inverter mode
	Walk-in Function	From 20% to 100% over 5 seconds
	Inrush Current	Less than 8 times rated current under synchronous operation
	Current Limit	115% maximum
	* Harmonic Currents	Less than 4% THD
Optional Bypass Input	Rated Voltage	208 Vac
	Voltage Variation	+10% to –15%
	Rated Frequency	50/60 Hz
	Number Phases / Wires	3 Phase / 4 Wire + GND
Battery	DC Nominal (Voltage	288 VDC (230 to 332 VDC)
	Float Charge (Regulation)	324 VDC (±2%) with 2.25 V/cell
	Ripple Voltage	2% R.M.S.
	**Rated Back-up Time	Refer to Battery System Manual
	Rated Charge Current	20.0 Amps ****
Output	Rated Voltage	208 / 120 VAC
	Rated Current	223 Amps
	Rated Power Factor	0.8 lagging
	Number Phases / Wires	3-phase / 4 Wire + GND
	Voltage Regulation (phase-phase)	± 2% (0-100% balanced load) ± 3% (0-100% unbalanced load)
	Voltage Adjustment Range	± 5V Manually from front key pad
	Phase Displacement	± 2° (0-100% balanced load) ± 4° (unbalanced load)
	Rated Frequency	50 / 60 Hz
	Frequency Regulation	± 0.1% in free running mode
	Frequency Synchronous Operation Range	± .5/1.0/1.5 Hz (± 1.0 Hz. std.) switch selectable by qualified technician
	Frequency Slew Rate	1 Hz/s to 3 Hz/s
	Voltage Transients (Recovery time: 50 mS)	± 3% (100% load step change) ± 5% (loss or return of input voltage) ± 3% (transfer of bypass to inverter)
	Inverter Overload Capacity	125% 30 sec ; 150% 5 sec
	Bypass Overload Capacity	1000% 10 ms; 125% 10 min.
	Crest Factor	2.5
	Neutral Line Conductor	1.73 times line rating
	Harmonic Voltage	1.5% max (linear load)
	Inrush Current protection	Automatic transfer to bypass, then retransfer to inverter
Environment	Efficiency (Typical)	AC/DC/AC: 89% ; DC/AC: 88%
	Heat loss to be removed	22,110 Btu/hr (5,570 kcal/hr)
	Audible Noise	75 dB (A) at 3.3 ft. (1 m) from the units front display
	Operating Temperature	0 – 104°F (0 – 40°C); optimal operating temperature: 77°F (25°C)
	Operating Humidity	Less than 90% RH (non-condensing)
	Altitude ***	Less than 3280 ft. (1000 m)

Items marked with an (*) are specified at rated conditions under balanced linear loads.

(**) Battery backup time may vary depending on the operating conditions and ambient temperature at the installation site. An initial charge time of 24 hrs is necessary to obtain proper battery performance level before the unit is placed in operation.
(***) At 6600 ft. (2000 m) above sea level, output capacity should be derated by 3% (Consult factory for higher elevations).
(****) Prolonged operation at this level requires derating of the maximum Operating Temperature to 95 °F (35 °C).

5.2 Specifications – 4200FA 80kVA with Internal Transformer

	Model Number	T42#3F800FAXXN
	Rated Output Capacity	80 kVA
	External Dimensions (W x D x H)	41 in. x 31 in. x 74 in. (1041 mm x 787 mm x 1880 mm)
	Weight	2200 lbs (1000 kg)
Main Input	Rated Voltage	# = (B-208, H- 220, C-240, N-380,Q-400/415, D-480, M-600)Vac
	Voltage Variation	+10% to –15% ; (-15% to –30%) ****
	Rated Frequency	50/60 Hz
	Number Phases / Wires	3 Phase / 3 Wire
	* Power Factor	Greater than 0.99 when in inverter mode
	Required Input Power	71 kW when in inverter mode
	Walk-in Function	From 20% to 100% over 5 seconds
	Inrush Current	Less than 8 times rated current under synchronous operation
	Current Limit	115% maximum
	* Harmonic Currents	Less than 4% THD
Optional Bypass Input	Rated Voltage	208Vac
	Voltage Variation	+10% to –15%
	Rated Frequency	50/60 Hz
	Number Phases / Wires	3 Phase / 4 Wire + GND
Battery	DC Nominal (Voltage Range)	288 VDC (230 to 332 VDC)
	Float Charge (Regulation)	324 VDC (±2%) with 2.25 V/cell
	Ripple Voltage	2% R.M.S.
	**Rated Back-up Time	Refer to Battery System Manual
	Rated Charge Current	20.0 Amps ****
Output	Rated Voltage	208 / 120 VAC
	Rated Current	223 Amps
	Rated Power Factor	0.8 lagging
	Number Phases / Wires	3-phase / 4 Wire + GND
	Voltage Regulation (phase-phase)	± 2% (0-100% balanced load) ± 3% (0-100% unbalanced load)
	Voltage Adjustment Range	± 5 V Manually from front key pad
	Phase Displacement	± 2° (0-100% balanced load) ± 4° (unbalanced load)
	Rated Frequency	50 / 60 Hz
	Frequency Regulation	± 0.1% in free running mode
	Frequency Synchronous Operation Range	± .5/1.0/1.5 Hz (± 1.0 Hz. std.) switch selectable by qualified technician
	Frequency Slew Rate	1 Hz/s to 3 Hz/s
	Voltage Transients (Recovery time: 50 mS)	± 3% (100% load step change) ± 5% (loss or return of input voltage) ± 3% (transfer of bypass to inverter)
	Inverter Overload Capacity	125% for 30 sec ; 150% for 5 sec
	Bypass Overload Capacity	125% for 10 min.; 1000% for 10 ms
	Crest Factor	2.5
	Neutral Line Conductor	1.73 times line rating
	Harmonic Voltage Distortion	1.5% max (linear load)
	Inrush Current protection	Automatic transfer to bypass, then retransfer to inverter
Environment	Efficiency (Typical)	AC/DC/AC: 84%; DC/AC: 83%
	Heat loss to be removed	35,052Btu/hr (8,830 kcal/hr)
	Audible Noise	75 dB (A) at 3.3 ft. (1 m) from the units front display
	Operating Temperature	0 – 104°F (0 – 40 °C); optimal operating temperature: 77°F (25 °C)
	Operating Humidity	Less than 90% RH (non-condensing)
	Altitude ***	Less than 3280 ft. (1000 m)

Items marked with an (*) are specified at rated conditions under balanced linear loads.

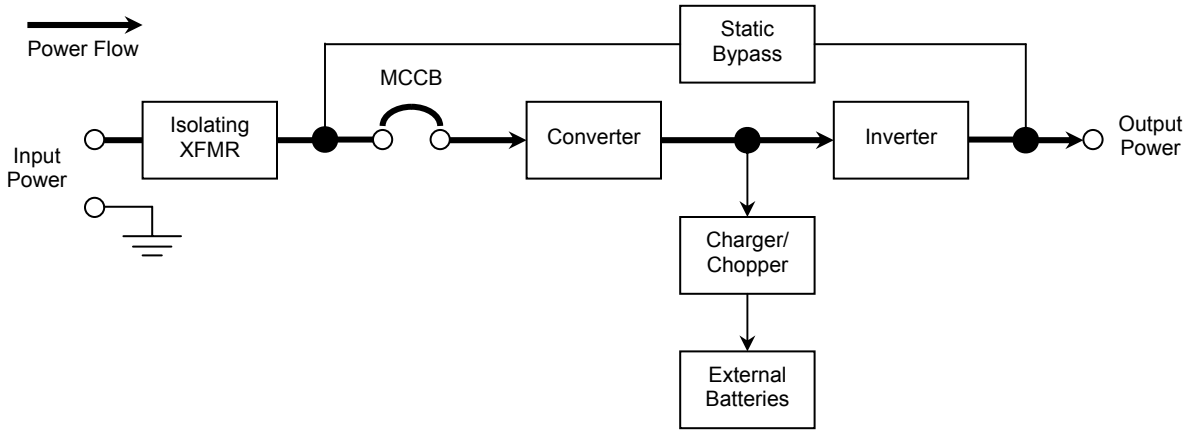
(**) Battery backup time may vary depending on the operating conditions and ambient temperature at the installation site. An initial charge time of 24 hrs is necessary to obtain proper battery performance level before the unit is placed in operation.
(***) At 6600 ft. (2000 m) above sea level, output capacity should be derated by 3% (Consult Factory for higher elevations).
(****) Prolonged operation at this level requires derating of the maximum operating temperature to 95°F (35°C).

6.0 Operating the UPS

6.1 Operating the UPS

6.1.1 AC Input Mode (normal operation)

The following illustration shows circuit power flow when the UPS is operating normally in the AC input mode. The converter of the UPS, including a boost chopper circuit, converts the AC input power to DC power. The boost chopper circuit maintains a constant voltage and provides current limiting for battery charging. It also supplies a DC voltage of the proper level to the inverter section. The inverter section generates a high quality sine wave output voltage. The UPS batteries always maintain a charge during normal UPS operation.

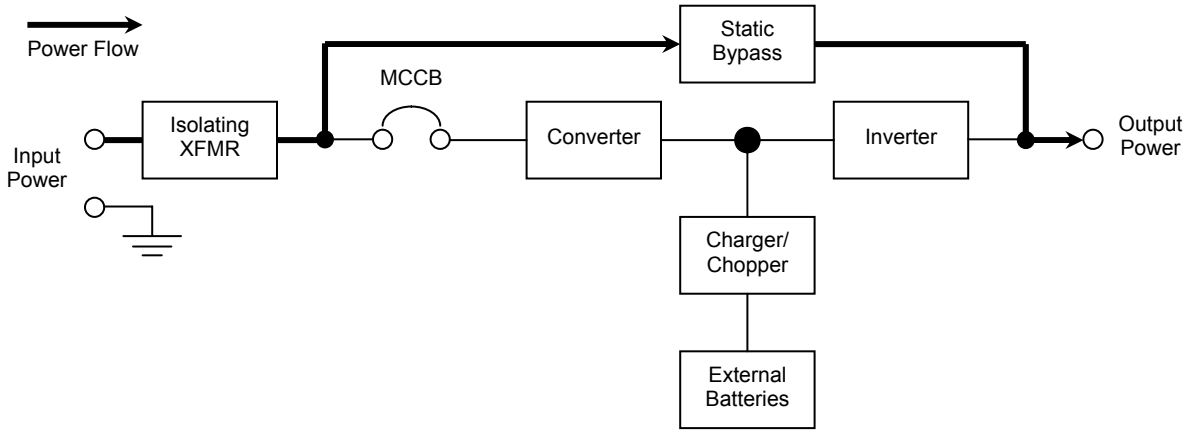


Power flow in AC input mode for the 4200*FA* 80 kVA UPS

6.1.2 Bypass Mode

If the UPS detects an overload or develops an internal fault, power flow is automatically switched from the main circuit of the UPS to the Bypass circuit. Power flow through the Bypass is shown in the following illustration. This changeover occurs automatically in less than 4 milliseconds. The switching period is not long enough to cause interruptions to occur in most loads. If the power flow is transferred to the bypass circuit because of an overload and the overload condition ends within a specified period of time, normal operation will resume automatically (see Section 6.16 Overload Operation).

If the power flow is transferred to the bypass circuit due to a fault condition, the power flow must be transferred manually from the Bypass circuit back to the inverter circuit after the fault is cleared (see Section 6.11 Start-up Procedure).

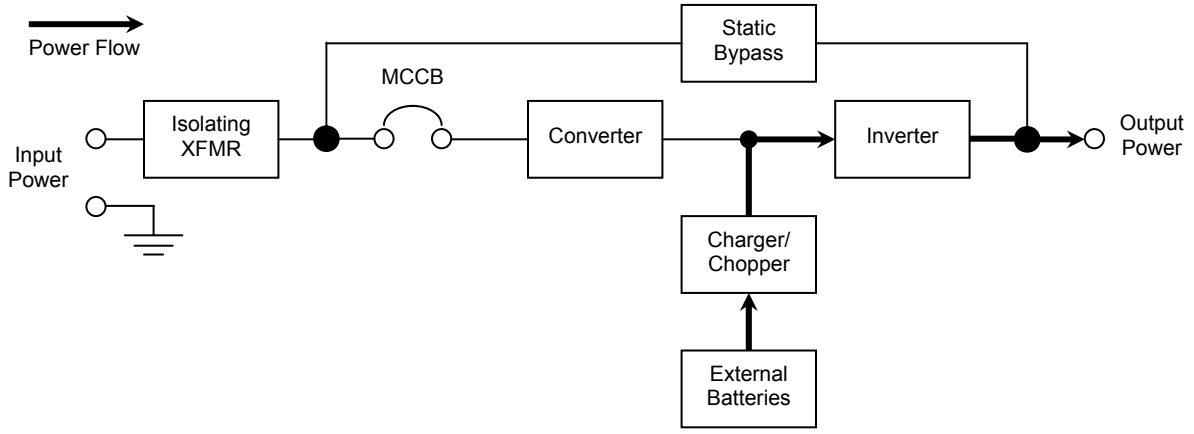


Power flow in circuit-bypass mode for the 4200FA 80 kVA UPS

6.1.3 Battery Backup Mode

The following illustration shows power flow during the battery backup mode. In the event of an AC power failure the batteries of the UPS instantly begin supplying DC power to the UPS to the main inverter circuit. This circuit converts the DC power into AC power. The AC power is available at the output of the unit. This back-up process will continue until the UPS battery voltage drops below a specific minimum level. At which time the batteries cease supplying power to the load.

This minimum level is the shutdown voltage minimum (V min). The rated battery voltage table on page 36 shows (V min). The battery backup time and discharge process is explained in Section 6.2.



Power flow in battery backup mode for the 4200*FA* 80 kVA UPS

6.1.4 External Maintenance Bypass (Customer Supplied)

An external maintenance bypass may be installed in parallel with the UPS to allow servicing of the UPS while maintaining power to the load. Contact an authorized service representative for further information.

CAUTION **Ensure the UPS is set to BYPASS mode before switching the external bypass from UPS to MAINTENANCE BYPASS.**

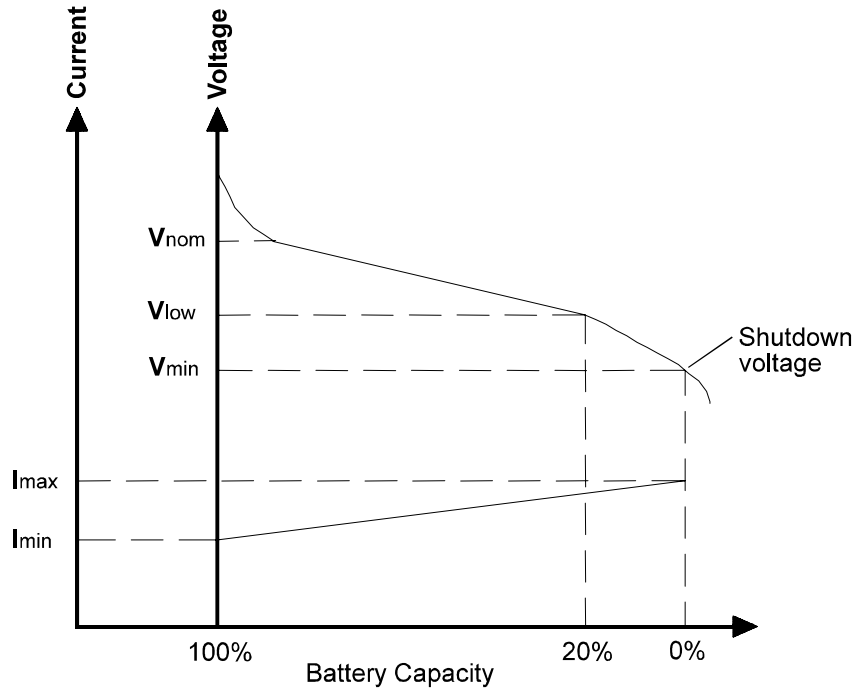
High transient currents may result if the external bypass is engaged while the UPS is in normal mode.

6.2 Battery Backup Time and Discharge Process

The UPS system, when used in conjunction with a TOSHIBA designed Battery System, is designed to provide several minutes of back-up time for the 4200*FA* UPS (Refer to the Battery System Manual for back-up times). These times are valid for full-load operation. At half-load operation the batteries can provide approximately 2 times the specified value. The exact times will depend on the UPS model used, condition of the batteries, amount and type of load, temperature, and other variables.

CAUTION Contact your TOSHIBA sales representative if using battery systems other than TOSHIBA designed battery systems to determine compliance. Using other systems may void the warranty and/or the safety certifications.

The following illustration shows the battery discharge process at full load conditions.



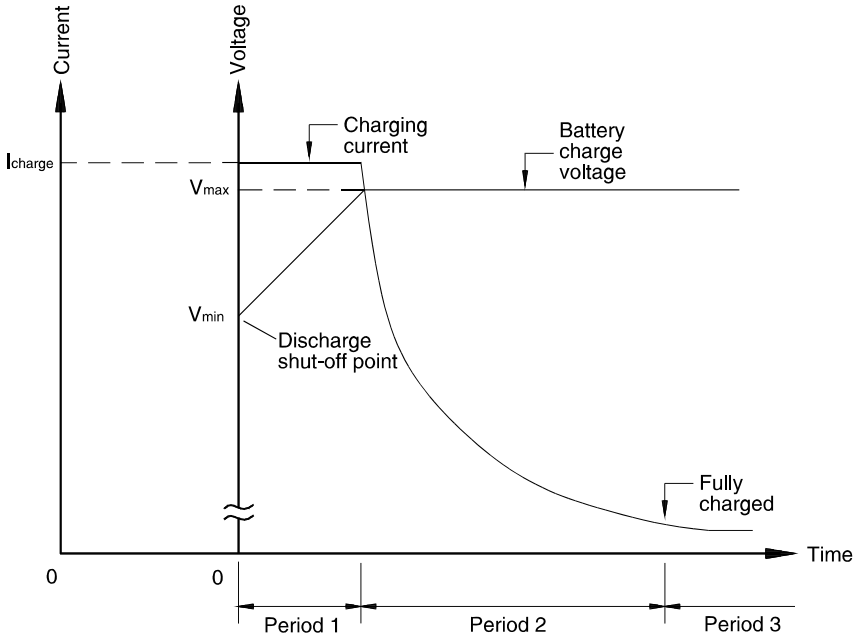
6.3 Battery Low Voltage Tolerances

Excessive discharge will cause the UPS battery voltage to drop below tolerable levels. The table below lists the normal operating voltage, the voltage levels at which the low-voltage alarm will sound, and the low-voltage level at which an automatic shut down will occur.

Nominal Voltage	288 VDC
Alarm Voltage	252 VDC
Shutdown Voltage min.	216 VDC

6.4 Battery Recharging

The illustration below shows the battery recharge process after a full discharge.



The recharge process typically consists of three periods. During the first period, the charging current is maintained at approximately 20.0 amperes. This current is the maximum value that can be used to charge the batteries (for minimal recharge time) while assuring safety and long battery life.

In the second period, constant-voltage control starts and the current gradually decreases as the batteries charge to the fully charged state.

In the third period, a trickle current continues to flow into the batteries to maintain the fully charged status at the normal DC Voltage level.

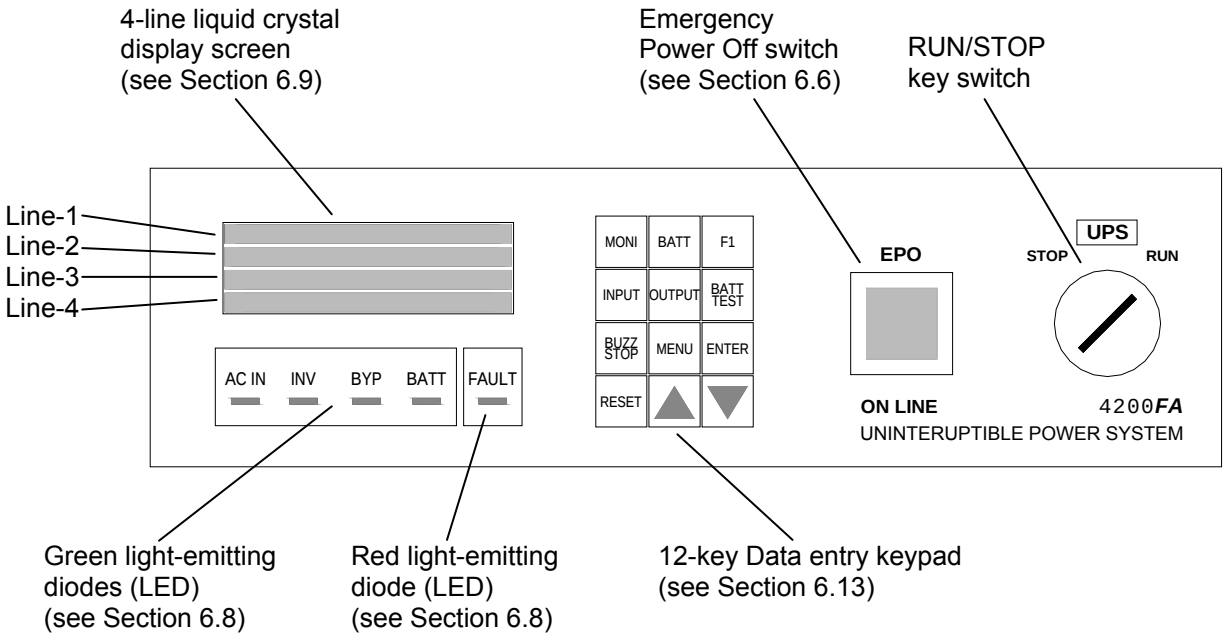
A full recharge requires approximately 24 hours (90% recharge in 10 X discharge time) after a complete discharge.

The following table shows the rated maximum and minimum battery voltages, and the charge current for each of the sizes for 75 °F (24 °C) operation.

Rated Battery Voltages

V float	324 VDC
V min	216 VDC
I charge	20.0 Amps

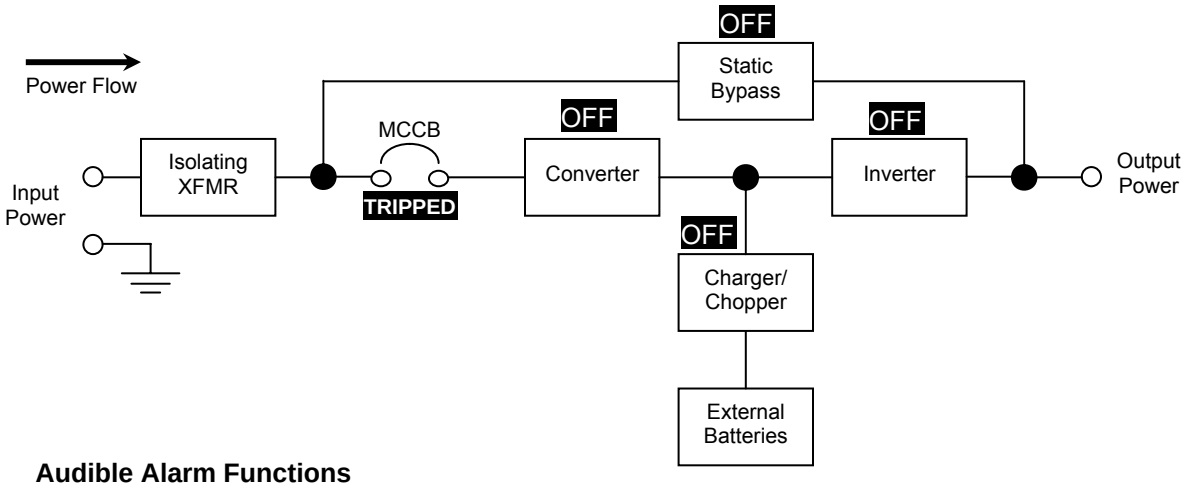
6.5 Front Panel Layout (All Units)



6.6 EPO (Emergency Power Off) Function

The 4200FA UPS system is equipped with terminals for receiving an emergency power-off (EPO) closed contact switch command from two locations: (1) a remote location (see Section 4.2 Terminal Block Details) and (2) from a front panel mounted EPO switch (see Section 6.5 Front Panel Layout).

This safety feature enables quick shutdown of the UPS AC output and battery circuits. Typically the emergency power off switch is installed in a central location that is easily accessible to personnel concerned with the operation of the UPS unit and the equipment connected to it. The EPO function is initiated by pressing the switch to the closed Shutdown position. The effect of using the EPO switch is the same whether the UPS unit is in the AC input mode (see Section 6.1.1), battery backup mode (see Section 6.1.3), or the circuit bypass mode (see Section 6.1.2). See EMERGENCY OFF screen in Section 6.12 Shutdown Procedure. The following figure shows the UPS condition after application of the EPO switch. *Use the Start-up Procedure (see Section 6.11) for restarting the unit.*



6.7 Audible Alarm Functions

While in the battery backup mode, during a fault, during a low battery condition, or if the system is in an overload condition, an audible alarm will sound. The following table shows the audible alarm pattern for each condition. Time intervals are shown in seconds. The audible alarm can be stopped by pressing the BUZZ STOP key (see Section 6.5 Front Panel Layout).

Condition	Audible pattern
UPS in Battery Backup Mode (Battery Voltage 100-90%)	7 S, 1 S
UPS Low Battery (Battery Voltage < 90%)	1 S, 1 S
Overload	.5 S, .5 S
Fault	.5 S, .5 S

6.8 User Notification LEDs

The following is a list of the user-notification LEDs and their function.

On when the UPS has normal AC input power that is within tolerance. If there is an input power failure this LED is off. If there is no power failure and the input voltage is in an over-voltage condition, the AC IN LED will flicker on and off rapidly (0.4 sec on and 0.4 sec off). If there is no power failure and the input voltage is in an under-voltage condition the AC IN LED will be off.

On when the UPS inverter is operating.

On when the UPS is in the static bypass mode.

On when the UPS is in the battery-discharge mode. If the battery is low during a battery discharge, the BATT lamp will flicker on and off slowly (1.2 second on and 1.2 second off). The BATT LED will go off if the battery voltage reaches the shutdown level during the battery-discharge mode.

On when the UPS is experiencing a fault.

6.8.1 LED System Status

The following table shows the UPS system status that can be determined by decoding the on and off condition of the LED lamps. It should be used in conjunction with the LCD display (see Section 6.9) and the audible alarms (see Section 6.7) for total system monitoring.

LED	ON/OFF STATUS	LED	ON/OFF STATUS
Normal UPS Operation (UPS on-line, no abnormal conditions)		Output Shutdown (After Emergency Power Off received (EPO))	
AC IN INV BYP BATT FAULT	ON ON OFF OFF OFF	AC IN INV BYP BATT FAULT	OFF OFF OFF OFF OFF
Bypass Operation; UPS Fault		Fatal Communication Error (Display to Control Interface)	
AC IN INV BYP BATT FAULT	ON OFF ON OFF ON	AC IN INV BYP BATT FAULT	ALL ON OR FLICKERING RAPIDLY
Battery Back-up; (Battery Voltage Low)			
AC IN INV BYP BATT FAULT	OFF ON OFF ON (Blinking) OFF		

6.9 LCD Functions

The LCD display is a 4-line by 20-character display. The LCD display conveys system operational information. It should be used in conjunction with the LED display (see Section 6.8) and the audible alarms (see Section 6.7) for total system monitoring.

Listed below are the types of user-notification messages that are available for each line of the LCD display screen and a description of each. This message displayed is determined by the UPS operating mode and conditions. These messages are shown in the following line message tables.

6.9.1 Line-1 System Messages

Line-1 messages are based on the operating mode. The following table shows all allowable Line-1 messages, which occur while starting up and while in main monitor **(**MONI) screen mode.

LINE-1 MESSAGES

Display Message	Description
- UPS START UP -	Displayed when UPS is in the start-up condition or display board is resetting.
- BYPASS OPERATION -	Displayed when the UPS is in Bypass Operation.
- UPS ON-LINE -	Displayed when the inverter is running.
- BATTERY DISCHARGE -	Displayed during Utility abnormality; inverter is supplying power from batteries. (Unit shuts down after $V_{min.}$ is reached.
- OUTPUT SHUTDOWN -	Displayed during power failure if $V_{min.}$ is reached, or an EPO is received, or after completion of Shutdown Sequence of the Inverter and Bypass is not available.
- BATTERY BACKUP -	Displayed during input power failure.

6.9.2 Line-2 System Fault Messages

Line-2 fault messages are automatically displayed when a system fault is detected.

LINE-2 MESSAGES

Display Message	Meaning
DCUV	DC Under-voltage
DCOC	DC Over-current
DCUB	DC Unbalanced
DCOV	DC Over-voltage
EERR	Main EEPROM error
OH	Overheat (internal)
OL	Output Overload
IVUV	Inverter Under-voltage
IVOV	Inverter Over-voltage

6.9.3 Line-3 System Messages

Line–3 messages show load current information, and user selected instructions.

6.9.4 Line-4 System Messages

Line-4 messages reflect the UPS operating conditions. Warning messages will be displayed when an abnormal operating condition occurs. The following table shows the allowable Line-4 messages.

LINE-4 MESSAGES

Displayed Message	Meaning
PHEI	Displayed when input Phase rotation has been wired in a counter clockwise rotation.
I/O NOT SYNCHRONIZE	Displayed when input and output frequencies are not synchronized. (abnormal)
*** AUTOTRANSFER ***	Displayed when auto-transfer to bypass is active (i.e. current limit reached). (abnormal)
*** BATTERY LOW ***	Displayed when battery voltage is low (abnormal) or the UPS batteries have failed self-diagnostic test. (abnormal)
*** UPS OL: REDUCE LOAD ***	Displayed when UPS has tripped due to an overload condition. (abnormal)
*** DCOC ***	Displayed when the UPS has an internal failure. (abnormal)
*** DCOV ***	Displayed when the UPS has an internal DC bus over-voltage. (abnormal)
*** DCUB ***	Displayed when the UPS has an internal DC bus unbalance referenced to Neutral. (abnormal)
*** UPS OL ***	Displayed when UPS has tripped due to an overload condition. (abnormal)
*** INOV ***	Displayed when inverter output over-voltage has occurred. (abnormal)
*** INUV ***	Displayed when inverter output under-voltage has occurred. (abnormal)
*** BATTOH *OR MCCB-B OPEN**	Displayed when the optional battery over-temp sensor has annunciated, or if the external battery disconnect is open. (Verify TB3-5,6)
*** UPS OK ***	Displayed when none of the above abnormal conditions are present. (normal)
*** DISCHARGE CURR=###% ***	Displayed when none of the above abnormal conditions are present and the UPS is in battery discharge mode. (normal backup)
*** TRANSFER INHIBITED ***	Displayed when key switch position is changed and frequency is not synchronized. (abnormal)
*** EMERGENCY OFF ***	Displayed when an emergency (EPO) signal is received.
*** UPS OUTPUT DISABLED ***	Displayed when UPS has normally shutdown.
*** FAULT(S) DETECTED ***	Displayed when a fault or faults have occurred. (abnormal)

Note:

1) Line-4 will be blank when the BATT key is pressed during battery backup mode with normal battery voltage.

2) The # symbol signifies numerical values or other information supplied by the UPS.

6.10 Initial Battery Charge

The battery of the UPS must be charged before it is used for the first time or if the unit has not been used (AC power source removed) for more than 10 days. Use the following procedure to recharge the battery of the UPS.

1) Switch on power at the UPS input distribution panel.

2) Move the MCCB power switch to On (see Section 4 for location). Note: The battery charging circuit is now activated. The AC IN lamp will be on. The LCD display (see Section 6.5 "Front Panel Layout") will display the following message:

- UPS START UP -
> PLEASE WAIT

3) With the key switch in the STOP position, the AC IN and the BYP lamp will be on and the LCD display will show the following message:

- BYPASS OPERATION -
OUTPUT VOLTAGE=208V
>CURRENT 100/100/100%
(DATE) DAY (TIME)

4) Turn the Key Switch to RUN and the UPS performs the Automatic Battery Test (The Automatic Battery Test is performed only when the software is enabled for this function. The default setting is Disabled).

(Allow 24 hours for the batteries to fully charge).

Should the Automatic Battery Test fail and the LOW BATTERY message is displayed use the following procedure:

1) Turn the key switch to STOP.

2) Allow 24 hours for the batteries to charge and, upon completion, move the MCCB switch (see Section 4 for location) to off.

3) Repeat Initial Battery Charge procedure (a failure indicates battery replacement required).

6.11 Start-up Procedure

The UPS batteries must be charged before the UPS is used for the first time or if the unit has not been used (ac power source removed) for more than 10 days (Refer to Section 6.10).

If the batteries are charged perform the start-up procedure as follows:

1) Verify that all power switches are off, and that the RUN / STOP Switch is in the STOP position.

2) Switch on the power at the customer-provided UPS input distribution panel.

3) Set the MCCB power switch of the UPS to On (see Section 4 for location). The AC IN lamp will be on. The LCD display (see Section 6.5 "Front Panel Layout") will show the following message:

- UPS START UP -
> PLEASE WAIT

Note: Lines 2 & 3 are blank.

With the key switch in the STOP position, both the AC IN and the BYP LEDs will be on and the LCD display will show the following message:

- BYPASS OPERATION -
OUTPUT VOLTAGE=208V
>CURRENT 100/100/100%
DATE (DAY) TIME

Note: Actual numerical values may differ from these examples.

The battery charging circuit of the UPS is now activated. Move the RUN/STOP key switch to the RUN position. The inverter of the UPS will start and the UPS will be in the normal operating mode.

Both the AC IN and the INV LEDs will be on. The following system message is an example of the main MONI (monitor) screen for standard operation (see Section 6.14.1 "MONI Function"):

- UPS ON-LINE -
OUTPUT VOLTAGE=208V
>CURRENT 100/100/100%
DATE (DAY) TIME

If a fault occurs during start-up, the red FAULT lamp will be on and the LCD display will display a FAULT(s) DETECTED at start-up message such as the following:

UPS FAULT (BYPASS ON)
(DESCRIPTION)
PRESS DOWN TO DETAIL
> ENTER FOR DETAILS

Note: UPS will not start when this message is displayed.

Refer to Section 6.9.2 — Line-2 System Fault Messages for details.

6.12 Shutdown Procedure

When turning off the UPS, the following shutdown procedure should be used.

1) Move the RUN/STOP key switch of the UPS to STOP. Operation of the inverter halts. Output power is now provided to the load via the bypass circuit. If a power failure occurs in the commercial power source while in this state, the UPS will lose power and power to the load will be interrupted. The battery charging circuit and chopper circuit will remain active.

DANGER ***Do not touch the UPS terminals even though the operation switch has been moved to the STOP position. The UPS may be supplying power through the bypass circuit.***

The LCD display shows the following message when in the Bypass operating mode:

```
- BYPASS OPERATION
OUTPUT VOLTAGE=208V
>CURRENT 100/100/100%
DATE (DAY) TIME
```

Note: Actual numerical values may differ from these examples.

Move the MCCB power switch to Off. **Power is removed from the UPS and to any attached loads**. All lamps are off and the LCD display shows the following message so long as there is sufficient power to display it:

```
- OUTPUT SHUT DOWN -
OUTPUT VOLTAGE= 0V
CURRENT=LOW/LOW/LOW%
```

Emergency Power Off activation trips the MCCB and power is removed from the UPS and to any connected loads (see Section 6.6 "EPO Function"). All LEDs are off and the LCD display will show the following message:

```
- OUTPUT SHUT DOWN -
OUTPUT VOLTAGE= 0V
CURRENT=LOW/LOW/LOW%
```

6.13 Keypad Overview

The following illustrates the 12-key data entry pad with each key functionally labeled (see Section 6.5 ─ Front Panel Layout).

MONI	**BATT**	**F1**
IN	**OUT**	**BATT TEST**
BUZZ STOP	**MENU**	**ENTER**
RESET	△	▽

MONI	Monitor: Press to display system-monitoring screens (see Section 6.14.1).
BATT	Battery: Press to display UPS battery conditions (see Section 6.14.4).
F1	Function Key: Press to change settings of various menus (see Section 6.14.5).
IN	Input: Press to display UPS input conditions (see Section 6.14.2).
OUT	Output: Press to display UPS output conditions (see section 6.14.3).
BATT TEST	Battery Test: Press to execute on-line battery test (see section 6.14.6).
BUZZ STOP	Buzzer Off: Press to stop the audible alert buzzer (see section 6.14.7).
MENU	Menu: Press to display the main menu (see section 6.14.5).
ENTER	Enter: Press to accept a user-selected command or action (see section 6.14.5).
RESET	Reset Display: Press to reset the message-display area of the UPS (see Section 6.14.8).
△	Up – Arrow: Press to scroll forward through display data values, or to scroll forward through menus (see section 6.14.5).
▽	Down-Arrow: Press to reverse scroll through display data values, or to reverse scroll through menus (see section 6.14.5).

6.14 Key Functions

6.14.1 MONI

Upon completion of a successful UPS startup, the system will be in the AC Input mode of operation. The LCD display will show the main MONI (monitor) function. If the MONI key is pressed at this time the display output will not change. The MONI function monitors the entire UPS system. The LCD display will switch off after a period of keypad inactivity and switch on if any key is pressed. It will switch on if the battery discharge reaches a critical level or if an abnormality develops in the system (see Section 6.15.3 — Settings for LCD Display Duration). All system line messages will be displayed from the MONI mode when system problems are detected. If the AC input power is available and no abnormal operating conditions are present the following system message is displayed:

```
- UPS ON-LINE -
OUTPUT VOLTAGE= 208V
CURRENT=100/100/100%
DATE (DAY) TIME
```

Note: Actual numerical values may differ from these examples. If output current drops below 15%, display reads: OUTPUT CURRENT=LOW.

If an AC input power failure occurs and no abnormal operating conditions are present, the UPS switches to standard Battery Backup mode. The following system message is displayed:

```
- BATTERY BACKUP -
OUTPUT VOLTAGE= 208V
CURRENT=100/100/100%
DATE (DAY) TIME
```

6.14.2 IN

Pressing the IN key during normal AC Input mode of operation displays input voltage information. The following system message is displayed:

```
- UPS ON-LINE -
INPUT      Vab= 100%
VOLTAGE    Vbc= 100%
           Vca= 100%
```

The bypass input voltage, frequency / Sync Mode, and converter current may be monitored by pressing the DOWN/UP keys.

6.14.3 OUT

Pressing the OUT key during normal AC Input mode of operation displays output voltage, current, and frequency information. The following system message is displayed:

```
- UPS ON-LINE -
OUTPUT     Ia =100%
CURRENT    Ib= 100%
           Ic= 100%
```

Note: If output current drops below 15% display reads: CURR=LOW.

The Output Line Voltages (phase-neutral, and phase to phase),
Frequencies / Sync Mode, Inverter Output Power, and Power Factor may be monitored by pressing the DOWN/UP keys.

6.14.4 BATT Key

Pressing the BATT key during normal AC Input mode of operation displays battery capacity information. The following system message is displayed:

```
- UPS ON-LINE -
BATTERY VOLTAGE= 324V
CHARGE CURR.=0%
```

Note: Discharge current in Line-3 is 0% unless unit is in the battery mode.

Note: Line-4 is left blank.

If an AC input power failure occurs and no abnormal operating conditions are present, the UPS switches to the Battery Backup mode. The following system message is displayed when the BATT key is pressed:

```
- BATTERY BACKUP -
BATTERY VOLTAGE= 324V
DISCHARGE CURR.=76%
```

Note: Line-4 is left blank.

6.14.5 MENU, F1, ENTER, UP/DOWN Keys

Press the MENU key during normal AC Input Mode of operation to access the menu of user adjustable data screens. Press the Up/Down arrow keys to scroll through the available data screens. Pressing the F1 key changes to the adjustment screen for that menu item. Press the Up/Down arrow keys to move the display to the next.

From the adjustment screen, if the MENU key is pressed any changes are discarded and the display returns to the regular menu screen with the previous data values shown. If the ENTER key is pressed from the adjustment screen, the changes are saved. After pressing ENTER, the display screen will return to the regular menu screen with the new data values shown (see Section 6.15 Menu Data Screens).

6.14.6 BATT TEST Key

Pressing the BATT TEST key during normal AC Input mode of operation displays battery back-up information. The following system message is displayed:

```
- BATTERY TEST -
BATTERY VOLTAGE= 324V

> F1+ENTER TO BEGIN
```

Press the F1+ ENTER keys at the same time to begin the battery test. The following system message is displayed:

```
- BATTERY TEST -
BATTERY VOLTAGE= 324V
## MINS ## SECS
> PLEASE WAIT
```

Upon completion of the battery test the previous operation is resumed and the main system MONI screen will be displayed. The following system message is displayed if the battery test detects a low DC battery voltage:

```
- UPS ON-LINE -
OUTPUT VOLTAGE= 208V
CURRENT=38/55/48%
* LOW BATTERY *
```

The following system message is displayed upon the successful completion of the battery test:

```
- UPS ON-LINE -
OUTPUT VOLTAGE= 208V
CURRENT=38/55/48%
DATE (DAY) TIME
```

Note: Press the **MONI** key to return to the main monitoring menu.

If the inverter is not operating when the BATT TEST key is pressed then the function will be inhibited (disabled) and the following screen message will be displayed:

```
- BATTERY TEST -
BATTERY VOLTAGE= 324V

BATT. TEST INHIBITED
```

NOTE:
After start-up, the battery test function is inhibited for 20 min. (Only one battery test can be done approximately every 20 min.).

6.14.7 BUZZ STOP Key

Turns off the audible alarm.

6.14.8 RESET Key

Resets the LCD display board software should a system lock-up occur. The reset does not reset memory variables.

Use of the RESET function is very important when a fatal communication error has occurred.

Press and hold the RESET key for five seconds or more to reset the display software. The display board-to-main board interface will begin a new communication sequence. If a communication response is not received by the display board from the main board within 15 seconds, a fatal time-out occurs and the following system message displays:

```
- DISPLAY ERROR -
MAIN COMM. ERROR

PRESS & HOLD RESET KEY
```

Note: If the error message persists contact the TOSHIBA Service Center.

Upon a successful Reset the Startup Screen appears followed by the Main Monitor.

6.15 Menu Data Screens

6.15.1 Settings for Calendar and Clock

Press the MENU key to access the system configuration screens. Press the Down arrow key until the time and date screen is shown:

```
   CALENDER / CLOCK
    DATE  (DAY)  TIME
>*F1: DATA SET MODE
>∆/∇ PRV/NEXT SCREEN
```

Press the F1 key to display the following active adjustment screen:

```
   CALENDER / CLOCK
    DATE  (DAY)  TIME
> ∆/∇ : UP/DOWN
>ENTER:NEXT DATA
```

Press the Up/Down arrow keys to adjust the character(s) above the flashing cursor.

Press the ENTER key to advance the cursor.

6.15.2 Adjusting Buzzer Volume

Press the MENU key to access the menu data screens and press the Down arrow key to access the Buzzer Volume adjustment screen:

```
BUZZER VOLUME ADJUST
<LOUD> MEDIUM  SOFT
>*F1: DATA SET MODE
>∆/∇:PRV/NEXT SCREEN
```

Press the F1 key to display the following active adjustment screen:

```
BUZZER VOLUME ADJUST
<LOUD> MEDIUM  SOFT
>∆/∇: CHANGE DATA
>ENTER:ACCEPT CHANGE
```

Press the Up/Down arrow keys to move the curser to any of the three buzzer volume levels. Press the ENTER key to accept the change or press the MENU key to discard the changes and return to the menu data screen.

6.15.3 Settings for Display Duration

The LCD display is designed to switch off after a user-set period of inactivity. To set the duration of inactivity allowed, press the MENU key to access the menu data screens. Press the Down arrow key to scroll to the Display Duration screen. The following system message is displayed:

```
DISPLAY DURATION SET
<3 MIN>          30 MIN
>F1: DATA SET MODE
>Δ/∇:PRV/NEXT SCREEN
```

Press the F1 key to adjust the LCD-Idle mode setting:

```
DISPLAY DURATION SET
<3 MIN>          30 MIN
>Δ/∇: CHANGE DATA
>ENTER:ACCEPT  CHANGE
```

Press the Up/Down arrow keys to toggle from 3 MIN to 30 MIN. Press the ENTER key to save the selection or press the MENU key to exit to the main menu and discard the change.

Under any of the following conditions the LCD will remain on continuously without regard to the Display Duration setting.

1) The UPS has received an emergency-off command.
2) The UPS is in battery discharge mode.
3) A fault has been detected in the main unit.
4) The UPS is in an overload condition.

6.15.4 Run Switch Select

Press the MENU key to access the menu data screens. Press the Down arrow key to scroll to the Run Switch Select screen.

```
  RUN  SWITCH  SELECT
  <LOCAL>     REMOTE
>*F1: DATA  SET  MODE
>Δ/∇: PRV/NEXT SCREEN
```

Press the F1 key to display the following active adjustment screen:

```
  RUN  SWITCH  SELECT
   <LOCAL>     REMOTE
>Δ/∇: CHANGE  DATA
>ENTER:ACCEPT  CHANGE
```

Press the Up/Down arrow keys to toggle from RUN to SWITCH. Press the ENTER key to save the selection or press the MENU key to exit to the main menu and discard the change (Remote S/U option required). This function is available in the Bypass mode only.

6.15.5 Serial Com Station Address

Press the MENU key to access the menu data screens. Press the Down arrow key to access the Run/Switch select screen.

```
SER COM STATION ADDR
STATION ADDRESS:   31H
>*F1: DATA SET MODE
> ∆/∇: PRV/NEXT SCREEN
```

Press the F1 key to display the following active adjustment screen:

```
SER COM STATION ADDR
STATION ADDRESS:   31H
>∆/∇: CHANGE DATA
>ENTER: ACCEPT  CHANGE
```

6.15.6 Output Voltage Adjustment

While operating in the AC Input mode, press the MENU key for 4 seconds or more to display the output voltage adjustment screen:

```
   OUTPUT VOLT. ADJUST
OUTPUT VOLTAGE =###%
>F1: DATA SET MODE
> ∆/∇: PRV/NEXT SCREEN
```

Press the F1 key to display the following active adjustment screen:

```
   OUTPUT VOLT. ADJUST
REFERENCE ADJUST: ##
>∆/∇: CHANGE DATA
>ENTER: ACCEPT  CHANGE
```

The fields marked ## will show the numerical value of the allowable voltage adjustment parameter values. Press the Up/Down arrow keys to adjust the setting ±5 volts. This results in a ±2 % change in the output voltage.

Attempts to adjust this setting while the inverter is not running will result in the following error message:

```
   OUTPUT VOLT. ADJUST
    ADJUST PROHIBITED
   DATA CANNOT CHANGE
> ∆/∇: PRV/NEXT SCREEN
```

6.15.7 Equalize Charge Mode Select

Contact Toshiba Customer Support toll free at 1-800-231-1412 before using this option.

DAMAGE to the battery system may occur if this option is used improperly.

6.15.8 Reset to Default Settings

Press the MENU key to access the menu data screens. Press the Down arrow key to access the original factory default settings adjustment screen:

```
      MENU DATA RESET
DATA  INITIALIZATION
>F1:  TO  ACCESS  RESET
>△/▽:PRV/NEXT SCREEN
```

Press the F1 key to display the following active adjustment screen:

```
      MENU DATA RESET
DATA  INITIALIZATION
> MENU:  NO  DATA  RESET
>ENTER: ACCEPT CHANGE
```

When the ENTER key is pressed the following factory defaults are reset:

1) Reset the voltage-reference setting to +0.
2) Reset the buzzer volume to loud.
3) Reset the serial station address to 31h.
4) Reset the idle mode to 3 minutes.

Press the MENU key to abandon the operation and return to the menu data screen.

6.16 Overload Operation

When the UPS is operating and an overload condition is detected the following screen is displayed.

```
- UPS ON-LINE -
OUTPUT VOLTAGE= ###V
OUTPUT CURRENT= ###%
*  UPS OL: REDUCE LOAD *
```

Note: ### indicates an actual numerical value.

After a period of time, if the overload is still not reduced and the RUN/STOP key switch is in the RUN position, the UPS will transfer to bypass automatically. If the overload condition is still present, the following screen will be displayed:

```
- BYPASS OPERATION -
OUTPUT VOLTAGE=208
CURRENT= 114/116/114%
DATE (DAY) TIME
```

If the RUN/STOP key switch is in the STOP position, the UPS is in the bypass mode, and if the overload condition is still present, the following screen will be displayed:

```
- BYPASS OPERATION -
OUTPUT VOLTAGE=208
CURRENT= 114/116/114%
DATE (DAY) TIME
```

After the load is reduced and if the RUN/STOP key switch is in the RUN position, the UPS will return to the Inverter mode of operation after a period of time. During the wait time the following screen will be displayed:

```
- BYPASS OPERATION -
OUTPUT VOLTAGE=208V
CURRENT= 100/100/100
>PLEASE WAIT
```

Or if the UPS is waiting and the RUN/STOP key switch is switched to the STOP position while the UPS is waiting the following screen will be displayed:

```
- BYPASS OPERATION -
OUTPUT VOLTAGE=208V
CURRENT= 100/100/100
>PLEASE WAIT
```

If the RUN/STOP key switch remains in the STOP position when the wait period of the UPS is complete the following screen will be displayed:

```
- BYPASS OPERATION -
OUTPUT VOLATAGE=###V
CURRENT=100\100\100%
DATE (DAY) TIME
```

If the RUN/STOP key switch remains in the RUN position when the wait period of the UPS is complete the following screen will be displayed:

```
- UPS ON-LINE -
OUTPUT VOLTAGE= 208V
CURRENT=100/100/99%
DATE (DAY) TIME
```

6.17 Backup History & Fault History

Pressing the MONI and F1 keys simultaneously for a few seconds will cause the Battery Discharge Count screen to be displayed.

```
BATT DISCHARGE COUNT
                # TIMES
> F1: FOR DETAILS
>Δ/∇: TO SCROLL
```

Press the F1 key to display the record relating to the first discharge event.

```
BACKUP HISTORY ( 1)
#MIN##SEC VB=324V
      BT *PF OL
>Δ/∇: EXIT        F1: NEXT
```

Press the F1 key again to display the record relating to each subsequent discharge event.

```
BACKUP HISTORY ( #)
#MIN##SEC VB=324V
      BT *PF OL
>Δ/∇: EXIT        F1: NEXT
```

Press the Up/Down arrow keys to return to the Battery Discharge Count screen.

```
BATT DISCHARGE COUNT
                # TIMES
> F1: FOR DETAILS
>Δ/∇: TO SCROLL
```

Press the Up/Down arrow keys to display the Fault Count screen.

```
TOTAL FAULT COUNT
                ## TIMES
> F1: FOR DETAILS
>Δ/∇: TO SCROLL
```

Press the F1 key to display the record relating to the first fault.

```
FAULT HISTORY ( 1)
      Date Time
      fault code
>Δ/∇: EXIT          F1: NEXT
```

Press the F1 key again to display the record relating to each subsequent fault.

```
FAULT HISTORY ( #)
      Date Time
      fault code
>Δ/∇: EXIT          F1: NEXT
```

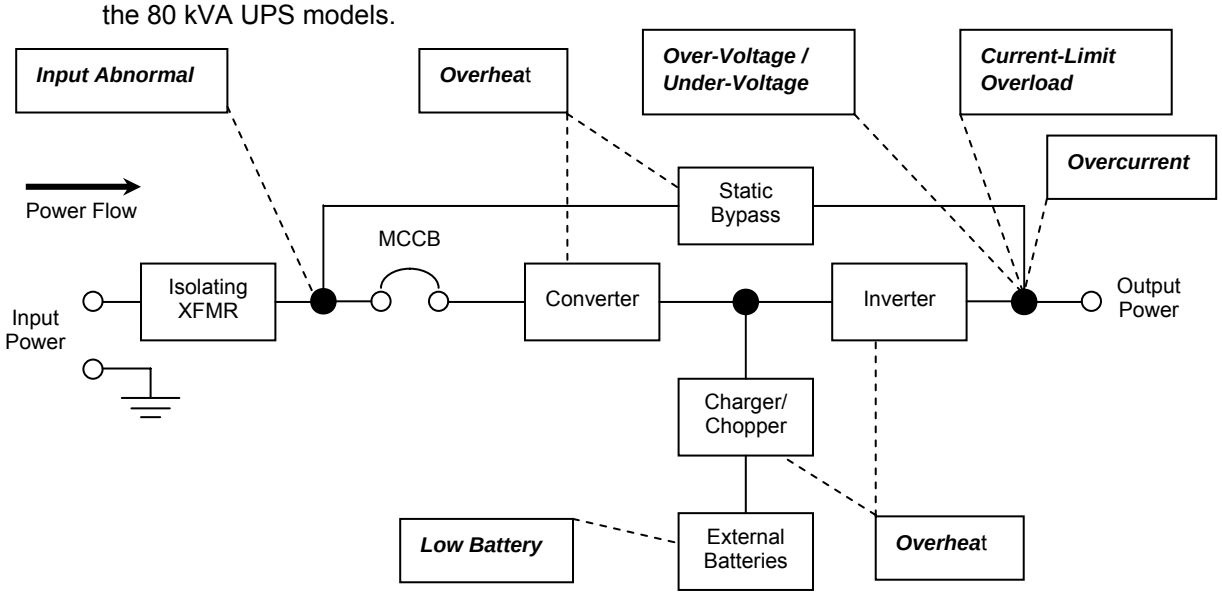
Press the Up/Down arrow keys to return to the Fault Count screen.

```
TOTAL FAULT COUNT
          ## TIMES
> F1: FOR DETAILS
>Δ/∇: TO SCROLL
```

7.0 UPS Protection System

7.1 System Protection Features

The following one-line schematic illustrates the electrical locations of the protection devices on the 80 kVA UPS models.



7.2 System Protection Functions

The following tables show the built-in UPS fault-protection functions of the 80 kVA models.

Built-in UPS Fault Protection Functions

Protection Item	Inverter Overvoltage (IVOV)	Inverter Undervoltage (IVUV)	UPS Overload
LCD Message	INVERTER OVERVOLTAGE	INVERTER UNDERVOLTAGE	OUTPUT OVERLOAD
Cause	Control Malfunction; Feedback Error		Overload or short circuit at the load.
Operation Mode after Fault	Bypass Operation; Chopper and Inverter Stopped		Inverter Overload: Transfer to bypass; Inverter stopped. Bypass Overload: Inverter, Chopper, & Bypass stopped.
Audible Alarm	Yes: See Section 6.7 Audible Alarm Functions		
Visible Alarm	Red Fault Lamp On		Inverter OL: No Fault Lamp — Bypass OL: Fault Lamp On
Relay Contact Alarm	Fault Relay closed; Bypass Relay closed		Inverter OL: Bypass Relay closed Bypass OL: Bypass Relay open and Fault relay closed
Auto-Retransfer	No		Inverter OL: Yes, if bypass OK — Bypass OL: No

Protection Item	Low Battery Voltage (level-1)	Low Battery Voltage (level-2)	Inverter Output Current Limit
LCD Message	Line-4 will read BATTERY LOW	DC UNDERVOLTAGE	OUTPUT OVERLOAD
Cause	Battery Discharge	Battery Shutdown Level reached	Load Inrush current
Operation Mode after Fault	Battery Discharge	Shutdown: No Output	If Bypass OK, transfer to bypass If not, current-limit mode
Audible Alarm	Yes: See Section 6.7 Audible Alarm Functions		
Visible Alarm	Battery Lamp Flickers	NO	NO
Relay Contact Alarm	Low Battery Relay closed	Bypass Relay closed	
Auto-Retransfer	No		Yes, if bypass OK

Protection Item	Memory error (EERR)	Internal overheat (OH)	DC circuit overvoltage (DCOV)	DC circuit overcurrent (DCOC)
LCD Message	MAIN EEPROM ERROR	OVERHEAT; INTERNAL	DC OVERVOLTAGE	DC OVERCURRENT
Cause	Control board chip error	Fan failure; high ambient	Chopper malfunction	Inverter / chopper fault
Operation Mode after Fault	Start is inhibited	Bypass operation; chopper and inverter are stopped		
Audible Alarm	Yes; continuous buzzer			
Visible Alarm	RED fault lamp On			
Relay Contact Alarm	Fault relay closed; bypass relay closed			
Auto-Retransfer	NO			

8.0 Preventive and Scheduled Maintenance / Part Replacement

8.1 Preventive Maintenance

TOSHIBA 4200*FA* Uninterruptible Power Systems have been designed to provide years of trouble-free operation requiring a minimum of preventive maintenance.

The best preventive measure that the UPS user can take is to keep the area around the unit, particularly the air inlet vents, clean and free of moisture and dust accumulations. If the atmosphere of the installation site is very dusty, use a vacuum cleaner to periodically remove dust accumulations from the system. Schedule authorized factory service representatives to perform internal parts inspections semi-annually.

CAUTION **Only factory trained representatives should perform repairs or maintenance on the UPS..**

CAUTION Proper maintenance of the battery system of this unit by a qualified service technician is essential to the safety and reliability of your UPS system. Refer to the battery service manual.

8.2 Parts Replacement

The following list shows intervals for periodic maintenance and replacement of certain UPS parts.

1) Batteries: Valve Regulated Lead Acid (VRLA) batteries are maintenance free with respect to electrolyte only. The charging voltage, temperature, performance and connection resistance must be monitored periodically. Necessary corrective actions must be made in order to assure safe reliable power is supplied by the UPS. The aforementioned items affect the life of batteries, so replacement should be once every 3 to 5 years as a minimum. All of the batteries must be replaced at the same time.

   Recommended Quarterly Maintenance

   A. Visual Checks
      1) Leakage.
      2) Corrosion on positive terminal.
   B. Check battery temperature at the negative terminal.
   C. Measure and record the system float charging voltage.
   D. Measure and record the float charging voltage of each unit.

   Recommended Semi-Annual Maintenance

   A. Repeat the quarterly checks.
   B. Perform impedance checks on the individual batteries.
   C. Test for the purpose of trending the battery over time.
   D. Re-torque all battery connecting hardware (if applicable).

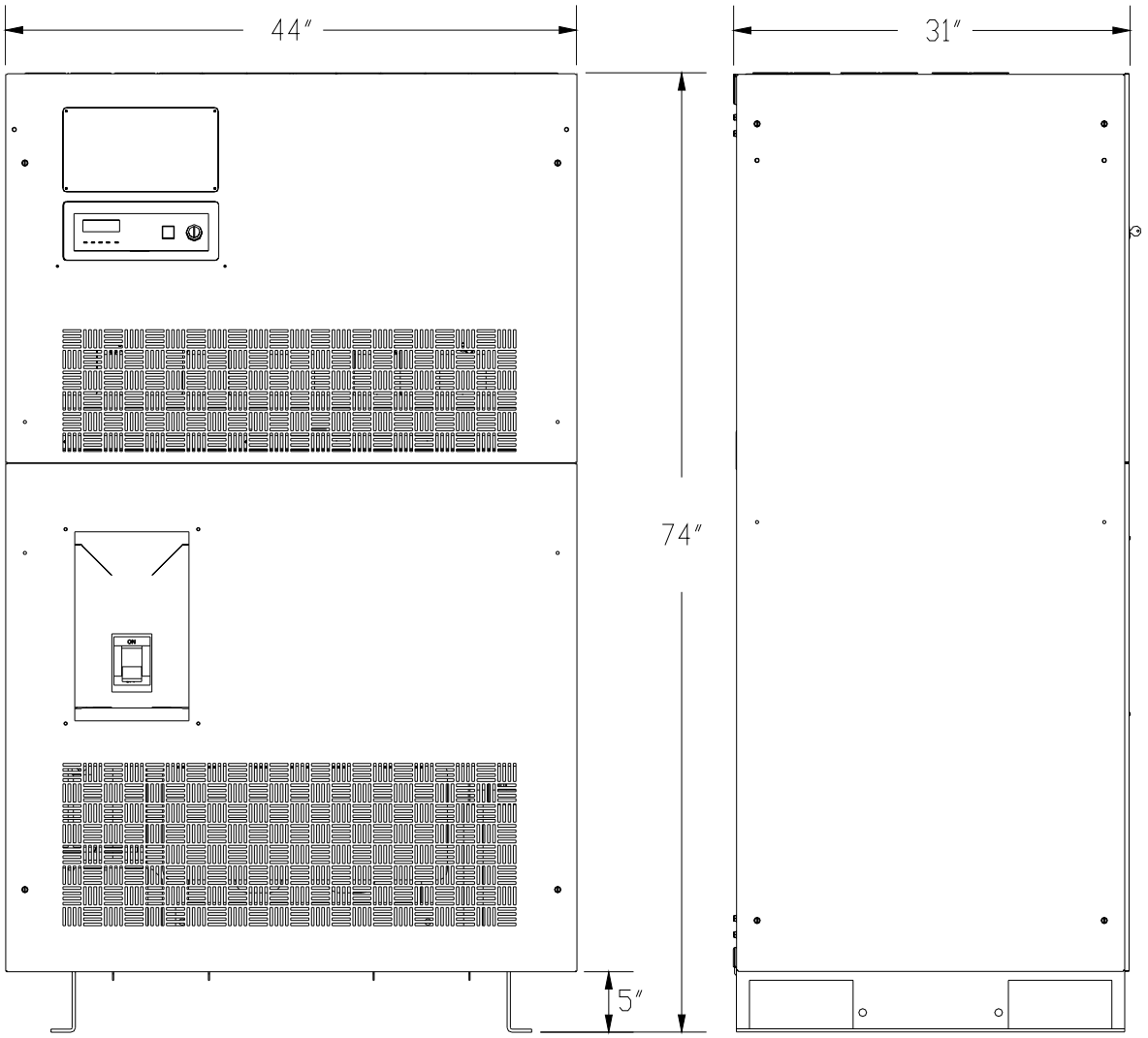
2) Aluminum electrolytic capacitors: Replace once every 5 years.

3) Fuses: Replace once every 7 years (see output fuse rating table below).

4) Cooling fan: Replace once every 3 years.

9.0 External Dimensions / Shipping Weights

9.1 External Dimensions



9.2 Shipping Dimensions

All models	Shipping Dimensions, Standard Inches (cm)	Shipping Dimensions, with crate Inches (cm)
Width	56.2 (143)	56.9 (145)
Depth	42.8 (109)	45.0 (114)
Height	79.0 (201)	81.8 (208)
Height with packing material	82.0 (208)	82.0 (208)

9.3 Shipping Weights

Model	Shipping Weight, Standard Pounds (Kilograms)	Shipping Weight, with crate Pounds (Kilograms)
T42B3F800FAXXN	2300 (1043)	2400 (1089)
T42D3F800FAXXN	2300 (1043)	2400 (1089)
T42F3F800FAXXN	2100 (953)	2200 (998)
T42M3F800FAXXN	2300 (1043)	2400 (1089)
T42N3F800FAXXN	2300 (1043)	2400 (1089)
T42F3D800FAXXN	2300 (1043)	2400 (1089)

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Printed in the U.S.A.